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Elliot R. Reiner and Albert E. Scheflen

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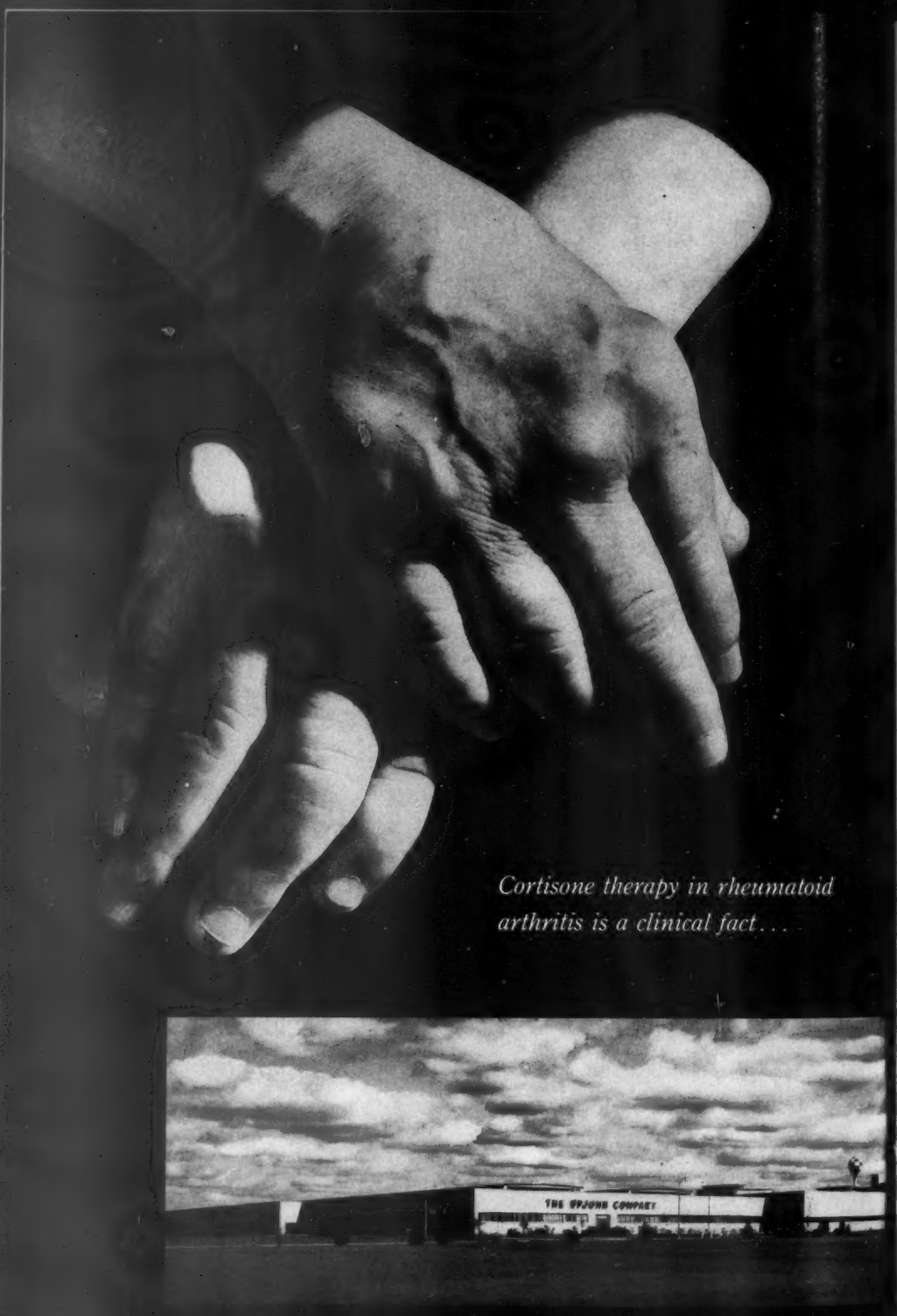

Cortisone therapy in rheumatoid arthritis is a clinical fact . . .

JOURNAL OF CLINICAL AND EXPERIMENTAL PSYCHOPATHOLOGY

The Vital Signs of Insulin Coma Therapy
A Statistical Evaluation*

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INTRODUCTION

The literature describing the vital signs during insulin hypoglycemia has contained many inconsistencies. The response of blood pressure during coma was described in one investigation as "usually not beyond physiological variations."[1] Wespi[2] thought a fall in blood pressure was the most common reaction. Others have described an increase in systolic blood pressure during coma.[3, 4, 5] Pessin[3] found a rise also in diastolic in two of his four cases, but most investigations reported a decrease.[4, 5, 6, 7] Many of the publications about autonomic function during insulin treatment do not describe blood pressure.[8, 9, 10] All authors report individual variations in pulse but vary in their opinions as to the most common reaction. The frequency of a slowing in pulse rate is emphasized by some,[11, 12] but later authors speak of tachycardia.[6, 7, 8] Parker[9] and Mayer-Gross and Berliner[4] described an initial rise in pulse rate, and a subsequent fall. Another author[1] found the opposite sequence. All these authors agreed that temperature regularly fell, and that marked varia-

* This is the first in a series of three articles.

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tions characterized all of the vital sign changes.

These marked variations may in part explain the discrepancies in the observations. Except for two[3,13] who measured a single vital sign, statistical analysis of the data was not used. Clinical impressions in the presence of marked fluctuations between subjects and within a single subject could be misleading. There has been much confusion about the nomenclature of the stages of coma. The bradycardia and low blood pressure reported in the literature about 1938 may be related to the low doses used in that period. It is our purpose to clarify the characteristics of the vital signs throughout the treatment period by a more careful description of methods and by the use of statistical analysis.

There is also a need for a composite picture of the vital signs during the entire daily treatment period. Some otherwise thorough studies did not include blood pressure,[8,9,10] while others dealt with a single vital sign.[3,13] We do not find a comprehensive study which statistically relates the vital signs to each other, to insulin dose, or the time intervals of the phases of the treatment period.

The inconsistencies in the descriptions of the vital signs are of considerable importance. Each author used his observations as a basis for formulations about the role of the autonomic nervous system in insulin hypoglycemia. Gellhorn[14] stressed sympathetic stimulation; Sakel, according to Parker,[9] vagotonia; Himwich et al,[15] parasympathetic activity. Others emphasized both components of the autonomic nervous system; Wespi[2] a disassociation between the components; Parker[9] an oscillation in activity between them, and Fortuyn[8] the simultaneous activity of both systems.

METHODS

Subjects. Twenty-four male schizophrenic patients treated with insulin coma therapy were studied. These patients were diagnosed and selected for insulin therapy by the clinical staff independently of the authors. There was no conscious selection of the patients for this study. Management of the patients and adjustment of dosage were performed by other physicians.

The mean age of the group was 26.6 ± 3.9 years. The mean duration of illness prior to treatment was 23.4 ± 30.6 months. Twelve patients were judged improved, and 12 were unimproved. Of the improved patients all remained well for at least one year. Improvement was judged by the use of weekly Malamud-Sands rating scales[16] throughout the treatment course, and by clinical evaluation as described in an earlier report.[17] Ten patients were diagnosed paranoid type, 5 catatonic, 1 hebephrenic, and 8 as other types of schizophrenia.

Treatment Procedure. Insulin treatments at this hospital were administered on 5 consecutive days each week. Patients were given insulin at 7:00 a.m. after 12 hours fasting. Crystalline insulin, 40 units, was administered intramuscularly into the gluteus. Doses were calculated to produce one hour of coma, beginning within 120 minutes after injection, and deepening to third stage just before termination. Coma was routinely terminated after 60 minutes or after five minutes of third stage coma. Termination was effected by the intravenous administration of 33 per cent glucose. No sedatives or other medications were

used in conjunction with the insulin therapy.

Observations. Observations were made on each subject every fifth treatment period. In each patient the observations were staggered so that they were not repeated on the same day of the treatment week. This avoided in any patient the consistent influence of the week end absence from therapy.

The following vital signs were recorded: blood pressure, pulse, respiration, and temperature. Clinical observations were made, including behavior, utterances, activity, perspiration, salivation, and skin color. The vital signs and observations were made at least every 10 minutes from 20 minutes before insulin injection to 30 minutes after termination. Throughout this period the patients remained in a supine position in bed. Temperature was measured rectally by use of a Liebel-Flarsheim hypertherm thermometer,* blood pressure by a Tycos aneroid sphygmomanometer, and pulse by counting the radial beats per minute. Insulin unit room temperature and humidity were not controlled. There were no statistically demonstrable relationships between temperature change of the patients with season of the year.

The Treatment Period. The treatment period is that period from 20 minutes before insulin injection to 30 minutes following termination. Fifty treatment periods constitute a treatment course. The data indicated division of the treatment period into six phases.

1. **Initial or preinjection phase.** The period from 20 minutes preceding to the time of injection of insulin.

2. **Latency phase.** The period from insulin injection to the onset of diaphoresis. There was a sudden and pronounced diaphoresis allowing a clear clinical delineation between the latency and the succeeding subcoma phase.

3. **Subcoma phase.** The 30 minute period following the onset of diaphoresis. Accompanying the diaphoresis there usually began a fall in temperature. This period was characterized by variations in the vital signs which were previously stable. A definite interval was chosen for statistical purposes. The period between diaphoresis and onset of coma varied markedly in different patients. Statistical comparison of the trends of change of vital signs, therefore, required use of a fixed time limit. Coma began in some patients 30 minutes after diaphoresis, so that a longer period of subcoma would not have been applicable to all patients. The 30 minute interval permitted in all subjects a comprehensive evaluation of the distinctive vital sign changes of the phase.

4. **Precoma phase.** The period extending from the end of the subcoma phase to the onset of coma. It is a construct for statistical purposes and is not recognizable clinically. This is *not* the precoma or half coma phase described by Von Braunmühl.[18]

5. **Coma phase.** The 1 hour period from the loss of consciousness or onset of the precomatous subdivision of "phase two"[19] to the beginning of the intravenous glucose injection. Unconsciousness is defined as the inability to obey simple com-

* Donation to this research by Liebel-Flarsheim Company, Cincinnati, Ohio.

mands or answer simple questions. The patient may react to painful stimuli by stirring or withdrawal but does not awaken. We term the failure to respond to painful stimuli as third stage coma or "real coma phase."[19]

6. **Postcoma phase.** The 30 minute period after the glucose injection was begun.

Statistical Methods. Differences between means were assessed by the t-score method; correlations by the product moment method. The term "significant" will apply to any relationship with a p value better than 0.01 (C.R. = 2.8); and "borderline significant" to any relationship between .05 and .01 (C.R. = 2.0—2.8).

RESULTS

THE VITAL SIGNS DURING THE TREATMENT PERIOD

The means and standard deviations for the group and the number of individuals showing significant changes in vital signs during each phase are shown on Table I. Significant events during each phase will now be summarized.

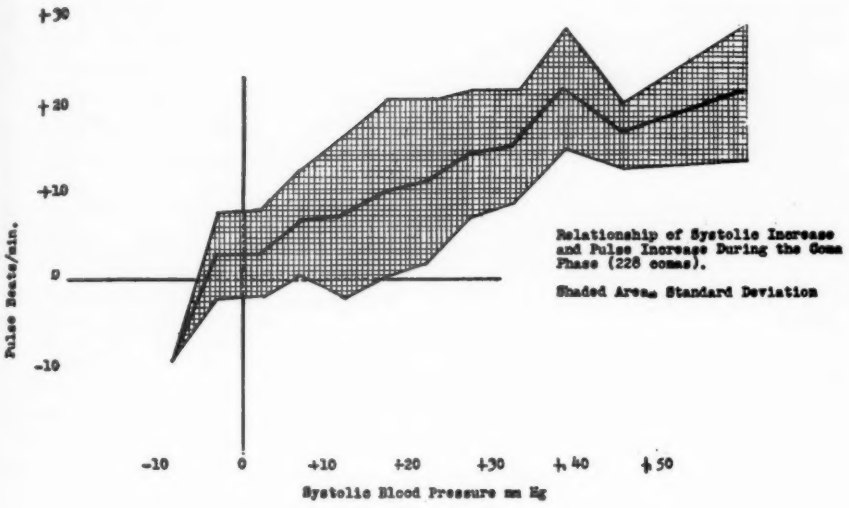
Preinjection Phase. The range of mean reading of individuals was: for temperature 97.7—99.0 F.; for systolic blood pressure 102—132 mmHg; for diastolic 51—77 mmHg; for pulse pressure 35—67 mmHg, and pulse 65—90 beats per minute. None of these are

TABLE I

The vital signs during the phases of the insulin treatment period.
Mean Values for the Group
Standard Deviations follow ± Sign

Phase	*Temperature ° F.*	*Systolic B.P. mm. Hg*	*Diastolic B.P. mm. Hg*	*Pulse Pressure mm. Hg*	*Pulse beats/minute*
Preinjection	98.37 ± 0.36	116.6 ± 9.4	67.0 ± 6.7	51.9 ± 8.5	79.9 ± 6.6
Latency	98.32 ± 0.10	118.4 ± 9.9	62.4 ± 3.4	55.7 ± 10.3	80.3 ± 6.6
Subcoma	98.02 ± 0.38	130 ± 10.9	52.2 ± 10.7	77.2 ± 17.0	85.2 ± 7.0
Precoma	97.64 ± 0.45	132.8 ± 7.0	47.4 ± 15.8	89.8 ± 23.1	83.9 ± 9.1
Coma	97.37 ± 0.66	139.7 ± 12.5	57.2 ± 11.6	82.9 ± 19.1	91.8 ± 8.5
Postcoma	97.25 ± 0.66	132.5 ± 12.8	66.3 ± 7.8	65.7 ± 16.0	91.0 ± 8.2
	Per cent of individuals showing change from preinjection values.				
Latency	4% dec.	8% inc.	13% dec.	21% inc.	4% inc.
Subcoma	50% dec.	79% inc.	50% dec.	87% inc.	33% inc.
Coma	83% dec.	96% inc.	29% dec.	100% inc.	67% inc.
			4% inc.		4% dec.
Postcoma	83% dec.	76% inc.	4% dec.	67% inc.	63% inc.
			8% inc.		

inc. = increase, dec. = decrease from preinjection values.
Per cent values are statistically significant.



GRAPH 1

considered abnormal for early morning resting values.

Latency Phase. None of the vital signs showed a significant mean change during this phase. Table I shows that very few patients evidenced a significant change in vital signs during the period. Variance was small, generally less than during the preinjection phase. Either autonomic reactivity was slight or was well compensated.

Subcoma Phase. With the onset of diaphoresis sudden and marked changes in vital signs occurred. The mean change above the previous period was significant for each vital sign, and Graph I shows that most individuals had a significant change. The changes were frequently abrupt. The trend was for a temperature decrease following the diaphoresis. This reached a maximum decrease of 2.2 F. in 30 minutes in one treatment period. The trend was for systolic blood pressure, pulse, and pulse pressure to increase; for diastolic to decrease.

Studying individual subcoma phases revealed that the greatest mean systolic increase was 42 mmHg, and the greatest mean pulse increase was 45 beats per minute. In 11 per cent of subcoma phases the mean pulse significantly decreased and this was often accompanied by a decrease in systolic blood pressure. In 2 patients this pattern was usual. Thus in a minority of subcomas vital sign changes occurred which have been interpreted as indicating para-sympathetic predominance. Mean diastolic pressure fell below 20 mmHg in 19 per cent of subcoma phases.

Precoma Phase. The decrease in temperature and diastolic and the increase in systolic blood pressure and pulse pressure continued. The lowest diastolic and largest pulse pressure

TABLE II

Mean Changes of Vital Signs from Preinjection Values and Variance Total of these Changes during the Treatment period.*

		Preinjection to latency	*Latency to subcoma*	*Subcoma to coma*	*Coma to postcoma*
Temperature	Mean Change	−.05 ±.1†	−.35 ±.38	−1.02 ±.66	−1.12 ±.66
(degrees F)	Variance total	.036	.220	.432	.559
Systolic Blood	Mean Change	+1.8 ±2.5	+13.4 ±6.4	+23 ±9.0	+16 ±8.1
Pressure (mmHg)	Variance total	35	132	172	164
Diastolic Blood	Mean Change	−3.7 ±3.4	−13.8 ±9.7	−9.6 ±10.9	+.3 ±6.7
Pressure (mmHg)	Variance total	40	265	342	236
Pulse Pressure	Mean Change	+5.6 ±4.7	+27.4 ±14.0	+32.8 ±16.0	+15.8 ±8.0
(mmHg)	Variance total	68	455	501	314
Pulse	Mean Change	+.4 ±2.2	+5.5 ±4.5	+4.0 ±9.3	+11.0 ±4.9
(beats per min.)	Variance total	20	93	182	125

* Variance total measures the total of each patient's variability in the means of individual treatment periods, not individual readings.

$$\text{Formula: } a^2 t = \frac{\Sigma\,(a^2 \cdot N)}{(\Sigma n) - N} \quad \text{or} \quad \frac{a^2_1 N_1 + a^2_2 N_2 \ldots a^2_r N_r}{(n_r + n_2 \ldots n_r) - N}$$

a^2 = variance; Σ = sum of; n = number of comas studied for each individual, and N = number of individuals.

† Number after ± sign = standard deviation.

readings occurred in this period.

Coma Phase. The means of the systolic blood pressure, pulse pressure, and pulse were markedly increased over the preinjection levels; the temperature and diastolic markedly decreased. These changes were seen in virtually all subjects. The trend changes in systolic blood pressure, pulse, and temperature seen in the previous phases continued, but the diastolic pressure now increased above that of the precoma phase, showing a significant return toward the preinjection value. Pulse pressure accordingly decreased, but not significantly.

The maximum temperature decrease for an individual coma phase was −4.8 F. In one coma phase temperature increased 1.1 F. An increase in temperature of +0.2 or more degrees above the preinjection level occurred in 5.4 per cent of coma phases, consistently occurring in 1 patient.

The largest increase in systolic blood pressure observed in any coma phase was +68 mmHg. In 1 patient a mean fall of systolic pressure of 11 mm of Hg was seen in two comas, but no patient had a consistent pattern of systolic decrease (Table I). In 16 per cent of coma phases mean diastolic pressure was below 20 mmHg. Mean diastolic increases of more than 10 mmHg above preinjection values occurred in 15.9 per cent of coma phases, occurring

consistently in 1 patient. In one coma phase the pulse pressure increased 140 mmHg. The greatest increase in pulse was +46 beats per minute. In 8 per cent of coma phases the pulse decreased below the preinjection level more than five beats per minute. Bradycardia (rate less than 65 beats per minute) was not observed in any coma.

Postcoma Phase. The mean temperature was lower than in the coma phase, but the difference was not significant. In no patient did temperature return significantly from the coma level toward the preinjection value. The mean systolic pressure was significantly higher than the preinjection level, but significantly lower than the coma phase level. In 59 per cent of the subjects the systolic pressure did not fall significantly below the coma phase value. The diastolic pressure was the only vital sign which returned to its preinjection value within the 30 minute postcoma phase. This completed a trend seen in the coma phase, during which the diastolic pressure of 66 per cent of the patients had returned. Pulse remained significantly increased and was not significantly lower than it had been during the coma phase.

Variability. The mean changes from phase to phase and the variance of these changes is summarized in Table II.

There is little variability during the latency phase between different determination, treatment periods or patients. At the onset of subcoma, however, a marked variability in both levels and degree of change of the vital signs begins. This persists throughout the treatment period. The variance indicates that hypoglycemia accentuated individual differences. Since measurements are made at ten minute intervals, it also demonstrates marked fluctuation in vital signs after diaphoresis has begun. It also indicates that within the individual variability in vital signs occurs from one treatment period to the next. However, there was a fairly consistent pattern in any subject in the direction of change.

THE INTERRELATIONSHIPS OF THE VITAL SIGNS

Graph I shows the relationship of pulse increase and systolic increase during the coma phase. The correlation is positive. The curve indicates a preponderance of sympathetico-adrenal activity, and the large standard deviation, since measurements are random in time, indicates fluctuation between sympathetico-adrenal and parasympathetic function, rather than a sustained activity.

The pulse rate and diastolic pressure values were negatively correlated during coma at a borderline level of significance. As expected, the pulse pressure change was related to systolic increase and diastolic decrease. Analysis of variance showed a highly significant relationship between pulse increase and temperature fall ($F = 14.7$; $p = .001$). Systolic increase was related to temperature fall, but the level of significance was not acceptable. The greater was the pulse and systolic increase, the smaller was the temperature fall.

The changes in the vital signs were not related to the preinjection levels.

THE RELATIONSHIP OF THE VITAL SIGNS TO OTHER FACTORS

Age. The levels of diastolic pressure had an insignificant positive relationship to age. Age was not related to other vital sign levels or changes.

Duration of Illness. No relationship between the vital sign measurements and duration of illness was demonstrated.

Size of Insulin Dose. The systolic pressure and pulse increases, and the diastolic decrease, tended to be larger as the insulin dose increased. Details will be published separately.

Progression of the Course of Treatment. In the last 25 comas there was a tendency during the coma phase for the systolic increase, the diastolic decrease, and the temperature fall to be less than it was during the first 20 comas. The initial levels also were slightly lower. Analysis of variance showed that none of these changes were significant, and that the lack of significance was not explainable by individual variability or sampling, but by the influence of another factor, possibly changes in dose. During the subcoma phase, however, the systolic increase and variance *did* become significantly less marked in the last 25 comas ($t = 2.7$; $p = .01$; $F = 1.9$; $p = .005$).

Improvement. The levels, change and variance of the phases were not related to improvement of the psychosis. These data will be published elsewhere.

Relationships of the Length of the Phases. The mean time intervals were:

The length of the latency phase..... 87 ± 21 minutes;
The combined subcoma-precoma phases..... 57 ± 19 minutes;
The total time from injection to coma.....144 ± 21 minutes.

The variance total of these intervals was very large, being 680, 840, and 927 respectively. This indicated marked differences in each individual from one treatment period to another.

For the group the length of the latency phase was inversely proportional to the length of the combined subcoma—precoma phases ($r = .62$; $p = .001$). In other words, the shorter the latency period the longer the interval from diaphoresis to the onset of coma.

The mean length of the latency period was 87 ± 21 minutes. During this interval there was no clinical evidence of autonomic activity or other signs of response to the injection of insulin. This was a surprisingly long interval of latency for an intramuscular injection. During this phase, however, considerable physiologic activity was judged to occur. Numerous investigators have shown that marked hypoglycemia has developed before the onset of subcoma.[20, 21, 22] Such a stress would presumably initiate homeostatic or defensive mechanisms. The absence of autonomic signs until the onset of subcoma indicates that these mechanisms do not include the sympathetico-adrenal system. The pituitary-adrenal system resists hypoglycemia[23] without clinical alteration of vital signs. This mechanism may be postulated to be active during the latency phase. The occurrence of subcoma and the length of the latency phase possibly reflects the complex relationships between the insulin effect, the amount of available glucose, the susceptibility of neurones to hypoglycemia, and the adequacy of the pituitary-adrenal homeostatic effect.

Activation of the sympathetico-adrenal system including the epinephrine-like effect would be a second homeostatic, or hypoglycemic defense mechanism. It is stimulated by a central mechanism when glucose deficiency in the hypothalamus becomes severe and

two relevant effects are produced: (1) changes in the vital signs, including increased systolic blood pressure and pulse rate, decreased diastolic pressure, and diaphoresis affecting temperature regulation; and (2) glucose mobilization preventing or delaying hypoglycemic coma. Such effects occurred suddenly at the onset of subcoma. Signs and symptoms of cortical dysfunction occur simultaneously. The onset of subcoma may mark the occurrence of cerebral glucose deficiency and activation of the sympathetico-adrenal defense. It presupposes some failure of the pituitary-adrenal mechanism. There seems to be a "one–two" defense against hypoglycemia. The negative correlation between the lengths of the latency and subcoma—precoma periods may reflect some relationship between these two homeostatic mechanisms.

Instances of bradycardia, miosis, and vasodilatation, the wide fluctuations in vital signs, and the work of Fortuyn,[8] Parker,[9] and Frostig[10] leave no doubt there is simultaneous parasympathetic activity and oscillation between sympathetico-adrenal and parasympathetic predominance. Vital signs readings, then, might depend upon the moment of observation offering an explanation for inconsistencies in previous reports. The vital signs are peripheral measurements of the algebraic sum of varying physiologic activity and such concepts as sympathetico-adrenal response must be considered in a relative, not an absolute sense.

The relative adequacy of the sympathetico-adrenal response seems to determine events subsequent to the onset of subcoma, including vital sign changes and resistance to hypoglycemia. If sufficient, coma may not occur at all. Coma predisposes some failure in the sympathetico-adrenal mechanism either by exhaustion, depletion of available glucose, or functional interruption in the central nervous system. Heilbrunn and Liebert[26] reported high adrenalin levels when comas were light or failed to occur, and an absence of adrenalin during deep coma. Relationships between indices of sensitivity to insulin and vital sign changes are to be presented in a companion paper. Vital sign changes indicating parasympathetic predominance have been reported. When these are contrasted to the marked increases in blood pressure and pulse rate in other subjects, the individual variations in responsivity are striking.

Although the epinephrine-like response has presumably failed when coma occurs, the increases in systolic blood pressure and pulse rate are maintained during the coma phase. It has been shown that pulse and systolic pressure during hypoglycemia increase even after adrenalectomy.[24] These increases during coma may be maintained by sympathetic vasoconstriction of peripheral arterioles even after depletion of epinephrine. The progressive temperature fall during coma and the tendency for diastolic to return toward basal levels support this view.

SUMMARY

A statistical analysis was presented of the vital signs in 24 schizophrenic patients treated with insulin coma therapy. During a latency phase of 87 ± 21 minutes significant changes did not occur. There followed a sudden diaphoresis beginning the subcoma phase, accom-

panied by abrupt fluctuations and changes in vital signs and impaired mental function. These changes were usually an increase in systolic blood pressure, pulse pressure, and pulse rate, and a decrease in diastolic blood pressure and temperature. After a mean time of 57 ± 19 minutes the coma phase occurred. These vital sign effects continued except that diastolic blood pressure tended to return to preinjection values, temperature further decreased, and systolic blood pressure and pulse rate continued to increase. After termination of coma with glucose there was a delayed tendency for the vital signs to return to the preinjection values.

The vital sign changes showed a significant interrelation and were related to other clinical features. These facts were used to postulate the role of pituitary-adrenal and autonomic nervous system function in insulin therapy.

RESUMEN

Se presenta un análisis estadístico de los signos vitales en 24 pacientes esquizofrénicos sometidos a la terapia por el coma insulínico. Diez pacientes fueron diagnosticados de esquizofrenia de tipo paranoide, 5 catatónicos, 1 hebefrénico y 8 de otros tipos de esquizofrenia. La edad principal de los grupos fué de 26,6 ± 3,9 años. La mínima duración de la enfermedad antes del tratamiento fué de 23,4 ± 30,6 meses. Doce pacientes fueron considerados mejorados y todos ellos continuaron bien por lo menos durante un año. La mejoría fué juzgada por el uso de mediciones semanales por las escalas de Malamud-Sands durante el tratamiento y por la evaluación clínica, según se describió en un informe anterior.

Los tratamientos con insulina fueron administrados semanalmente durante 5 días consecutivos. Los pacientes recibieron la insulina a las 7 de la mañana, después de 12 horas de ayuno. Se inyectaron intramuscularmente 40 unidades de insulina cristalina en la región glútea. Las dosis fueron calculadas para producir una hora de coma, comenzando 120 minutos después de la inyección y profundizándose hasta la tercera fase antes de la terminación. El coma fué terminado sistemáticamente al cabo de 60 minutos o de 5 minutos de su tercera fase. La terminación se efectuó por la inyección intravenosa de glucosa al 33 por ciento. No se usaron sedantes ni otros medicamentos al mismo tiempo que la terapia insulínica.

Se observaron los siguientes signos vitales: presión de la sangre, pulso, respiración y temperatura. Se hicieron observaciones clínicas de la conducta, expresiones vocales, actividad, sudor, salivación y color de la piel. Los signos vitales y observaciones fueron anotados por lo menos cada 10 minutos a partir de los 20 minutos anteriores a la inyección de insulina hasta 30 minutos después de la terminación. Durante este período los pacientes permanecieron en cama en decúbito supino. La temperatura fué tomada rectalmente empleando un termómetro ("hyperthem") de Liebel-Flarsheim, la presión arterial por un esfigmomanómetro aneroide de Tycos y el pulso contando los latidos radiales por minuto. No se controlaron las unidades de insulina, la temperatura ambiente

y la humedad. No se pudo demostrar estadísticamente que existiera una relación entre los cambios de temperatura de los pacientes y la estación del año.

Durante la fase de latencia de 87 ± 21 minutos, no ocurrieron cambios importantes. A continuación sobrevino una súbita diaforesis comenzando la fase del subcoma, acompañada de fluctuaciones abruptas y cambios en los signos vitales y función mental alterada. Estos cambios fueron generalmente un aumento en la presión arterial sistólica, presión y frecuencia del pulso y disminución en la presión arterial diastólica y temperatura. Después de un tiempo medio de 57 ± 19 minutos, se presentó la fase de coma. Estos vitales efectos continuaron, excepto que la presión arterial diastólica tendió a volver al valor anterior a la inyección, continuó la disminución de la temperatura, y la presión arterial sistólica y la frecuencia del pulso continuaron aumentando. Después de terminar el coma dando glucosa, hubo una tendencia retardada para volver los signos vitales al valor que poseían antes de la inyección. Los cambios vitales mostraron una interrelación significativa estando relacionados con otras características clínicas. Estos hechos fueron utilizados para postular el papel de la hipófisis suprarrenal y del sistema nervioso autónomo en la terapia insulínica.

RESUME

Il a été présenté une analyse statistique des signes vitaux parmi 24 cas schizophrènes de sexe masculin traités par la comathérapie à l'insuline. Le diagnostic de ce groupe a révélé 10 cas du type paranoïde, 5 cas catatoniques, 1 cas hébéphrénique, alors que les 8 cas restants ont été classés comme autres types de schizophrénie. L'âge moyen du groupe était de 26,6 ±3,9 ans. La durée moyenne de la maladie avant l'institution du traitement avait été de 23,4 ±30,6 mois. On a jugé que 12 malades s'étaient améliorés, alors que les 12 autres ne présentaient pas d'amélioration. Dans le groupe des sujets améliorés, tous se sont maintenus en bonne santé pendant un an au moins. L'amélioration des malades a été jugée au moyen d'échelles d'évaluation hebdomadaires Malamud-Sands pendant toute la durée du traitement, et par évaluation clinique de la manière décrite dans un rapport antérieur.

Les traitements à l'insuline ont été administrés pendant 5 jours consécutifs de chaque semaine. L'insuline a été donnée aux malades à 7 heures du matin après un jeûne de 12 heures. L'insuline cristallisée, 40 unités à la fois, a été injectée par voie intramusculaire dans le fessier. Les doses ont été calculés pour produire une heure de coma, commençant 120 minutes après l'injection, et s'approfondissant jusqu'à la troisième phase de coma juste avant de prendre fin. Régulièrement, on a mis fin au coma après 60 minutes en tout ou après 5 minutes de troisième phase de coma. Pour terminer le coma, on a effectué l'administration par voie intraveineuse de glucose à 33 pour cent. On n'a employé aucun sédatif ou autre médication en association avec la thérapeutique à l'insuline.

Les signes vitaux suivants ont été relevés: la pression sanguine, le pouls, la respiration, et la température. Les observations cliniques qui ont été faites ont porté sur le com-

portement, les paroles prononcées, l'activité, la transpiration, la salivation et la couleur de la peau. Les signes vitaux et les observations ont été relevés au moins toutes les 10 minutes pendant une période commençant 20 minutes avant l'injection d'insuline et se terminant 30 minutes après la fin du traitement. Pendant toute cette période, les malades sont restés au lit en position de décubitus dorsal. La température a été mesurée par le rectum au moyen d'un thermomètre hyperthermique Liebel-Flarsheim,* la pression sanguine à l'aide d'un sphygmomanomètre anéroïde Tycos, et le pouls en comptant le nombre de battements radiaux à la minute. La température ambiante et l'humidité du groupe à insuline n'ont pas été contrôlées. Il n'y a pas eu de relations démontrables par des statistiques entre le changement de température des malades selon la saison de l'année.

Au cours d'une phase d'état latent de 87 $\pm$21 minutes, on n'a pas observé de changements appréciables. Puis une diaphorèse soudaine a suivi et a marqué le début de la phase de subcoma, accompagnée de fluctuations brusques et de changements dans les signes vitaux, ainsi qu'une détérioration de la fonction mentale. En général, les changements observés ont été une augmentation de la pression sanguine systolique, de la pression pulsatoire et de la vitesse du pouls, en même temps qu'une diminution de la pression sanguine diastolique et de la température. La phase du coma est survenue après une durée moyenne de 57 $\pm$19 minutes. Ces effets sur les signes vitaux ont continué, sauf que la pression sanguine diastolique a tendu à revenir aux valeurs antérieures à l'injection, la température a continué de diminuer, alors que la pression sanguine systolique et la vitesse du pouls ont continué d'augmenter. Après qu'on a mis fin au coma par injection de glucose, les signes vitaux ont manifesté une tendance à ne revenir aux valeurs antérieures à l'injection qu'avec un certain retard. Les changements accusés par les signes vitaux ont révélé une relation mutuelle significative et ont montré une relation déterminée avec les autres aspects cliniques. Ces faits ont été utilisés pour pressentir le rôle de la fonction du système pituitaire-surrénal et du système nerveux autonome dans la thérapeutique à l'insuline.

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Hypnosynthesis*

HYPNOTHERAPY OF THE HYSTERICAL DEPRESSION WITH A DISCUSSION OF SEXUAL FANTASY AND NEUROTIC HOSTILITY IN TERMS OF INTERPERSONAL ATTITUDES AND RELATIONSHIPS

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In 1896, six years after Freud had replaced hypnosis with the method of free association, he put forward the proposition that at the bottom of every case of hysteria will be found one or more experiences of premature sexual experience belonging to the first years of childhood. In the forthright manner which only genius has the right to assume he stated, "I believe this to be a momentous revelation, the discovery of a *caput Nili* of neuropathology," referring to the most important geographic discovery of the nineteenth century—the discovery of the sources of the Nile.

Nine years later, in 1905, Freud wrote, "I overestimated the frequency of these occurrences (infantile seduction). . . . I have since learned to unravel many a phantasy of seduction and found it to be an attempt at a defense against the memory of the sexual activities practiced by the child himself (masturbation). . . . This same explanation, by which I was able to correct the most momentous of my early errors, necessitated a change in the conception of the mechanism of hysterical symptoms. These now no longer appeared as direct deviations of repressed memories of sexual experiences in childhood; but on the contrary, it appeared that between the symptoms and the infantile impressions were interpolated the patient's phantasies (memory-romances) created mostly during the years of adolescence and relating on one side to the infantile memories on which they were founded, and on the other side to the symptoms into which they were directly transformed." From a historical point of view, Freud's "fateful revision of theory" served to focus attention upon "childhood experiences as being of greatest importance for subsequent personality development; and that the effects of such experiences continue to operate outside of conscious awareness."[1,2]

A number of explanations have been offered in an effort to understand the origin of these infantile sexual phantasies. The earlier formulations bluntly accused Freud of manufacturing the data which he had so laboriously gathered from his hysterical patients. Ashaffenburg asserted that, "Freud must question his patients regarding their sexual life in a pe-

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culiarly impressive manner; he must influence them by suggestion in one way or another, so that he gets the answers he wants." Ladame seriously offered the ingenuous explanation, which today appears humorous, "that there must be a peculiar kind of sexual atmosphere in Vienna . . . so that in this environment the observer is foredoomed to overestimate the importance of sexual influences." Even the clinically astute Janet was of the opinion that "in contemporary civilization the events which are most apt to induce emotion and the facts about which men and women are usually inclined to be reticent . . . are almost always happenings in the domain of the sexual life." "Therefore," according to Janet, it was "Freud's way of regarding traumatic memories and subconscious fixed ideas which had led him to exaggerate the importance of sexual experiences."

As late as 1947, Hendrick in discussing Freud's revision of his earlier account of infantile traumatic "memories" stated, "Even though the external events reported as memories had not actually occurred, the occurrence of the patient's pseudo-memory was a fact in itself. Though it was highly improbable that certain external situations would recur with the frequency with which they were reported, it was not improbable that all children might be disposed to imagine similar events than that widely separated races should have many similarities in their myths. . . . It is not always an event, but may be a phantasy that is repressed; and when such a phantasy is recovered in psychoanalysis, it again manifests that convincing similarity to actual experience it had originally had in childhood. . . . The point is that phantasies of infants when repressed may exert the same dynamic and continued effect on the adult personality as actual experience. This conception," continues Hendrick, "is a landmark second only to the recognition of the unconscious, not only in psychoanalysis but in all departments of clinical psychiatry. It is the point where today psychologically-minded scientists and those who insist there is no objective validity where statements have no external justification part company."

This paper presents clinical data obtained during the hypnotherapy of hysterical depressed patients, data which help to explain the nature and origin of the sexual phantasies that Freud was the first to discover.

After Freud had corrected his earlier assumption that accidental childhood sexual experiences produced a specific predisposition to hysteria, he then focussed all of his attention upon the sexual constitution ("Those organic processes which determine the development and form of expression of the sexual craving.") As Thompson has aptly stated, "Freud's turning away from environmental factors to organic constitution as a major concern led him to 'minimize' (for at least a long time) what actually happens between people . . . the dynamic interaction between people which provides the locus of functional mental illness."

Before presenting the clinical material it might be of interest to comment briefly upon the emphasis which is being placed upon meeting the specific psychologic needs of the patient in the trance state and the necessity for making the interpersonal situation as effective as possible. Thus Erickson has stressed "the great need for the patient to participate actually in any reorganization of his psychic life," and has advised that "the hypnotist should use that technique which permits him to express himself most satisfactorily and effectively in the special interpersonal relationship which constitutes hypnosis."

In a previous paper, in 1949, the author expressed his doubt "as to the need to use" sleep suggestions (that the patient will wish to sleep, that he will become tired and sleepy, etc.) in the induction of the trance state. This type of formulation presents hypnosis as being closely allied to physiological sleep, and necessarily implies a maximal degree of passivity on the part of the patient, who supposedly is being overcome by an impersonal process. This is in contrast to the concept of active patient-participation which seems to be closer to the facts as derived from laboratory records, psychological studies and clinical practice, and which offers for therapeutic purposes a greater opportunity for eliciting and modifying the patient's spontaneous motivational forces.

It is of historical interest to record that the value of active patient-participation in the therapeutic relationship was recognized as early as 1850. Deleuze in his *Practical Instruction in Animal Magnetism* admonished his fellow magnetizers not to collect observations merely to satisfy their curiosity concerning the somnambulist state but to ask only those questions which were necessary in order to cure the patient. Deleuze suggested that the somnambulist be asked the following questions:

"Do you feel well?"
"Does my manner of proceeding agree with you?"
"Will you point out any other mode?"
"How long shall I let you sleep?"
"How shall I awake you?"
"When shall I magnetize you again?"
"Have you any directions to give me?"
"Do you think I shall succeed in curing you?"

Deleuze also had indicated what was to be rediscovered more than a hundred years later: That the hypnotic trance can be produced "contrary to the subject's and even contrary to the operator's expectation." He described how he had placed his hand upon a patient's shoulder "and was very much surprised to see her close her eyes, and in a few minutes fall into a state of somnambulism." Deleuze went on to say, "I did not produce it myself . . . because I did not intend to and because I avoided acting on the head." According to the prevailing theories of magnetism, only the latter maneuver should have produced the effect of somnambulism. As a probable explanation of what had occurred, the patient had been prepared, "conditioned," by the 15 mesmeric treatments which her husband had given her and had responded to a signal, the placing of the operator's hand upon her shoulder.

Freud was a skilled hypnotist who had been influenced by Charcot and Bernheim, both of whom were authoritarian personalities. When Freud gave up the practice of hypnosis in 1890 in order to develop the method of "free association," he substituted a patient-centered approach for a physician-centered hypnotic technique. By placing the responsibility for therapeutic change directly upon the patient, Freud encouraged him to actively participate in his own treatment. It was this innovation which introduced the era of dynamic psychotherapy.

The author's procedures for the induction of the trance state have been described in a previous paper, in 1949.

CLINICAL PRESENTATION

The first case presents the manner in which a patient terminated a severe hysterical depression of five years' duration.

William B. was 22 years old when he started treatment in 1941. He presented the features of acute anxiety, depression, and a marked tremor (intentional tremulous incoordination). During the year preceding hypnotherapy, 1941–42, Mr. B. had completed his professional training, then had become progressively more despondent, anxious and drank excessively while under treatment (distributive analysis).

The patient is the youngest of 4 children. The oldest sister is emotionally stable; the second sibling, a sister, recently experienced a severe hysterical illness requiring prolonged hospitalization. The third sibling, the patient's older brother and father's namesake, is a spree drinker who has wrecked several cars. He disappointed his self-educated, moody, successful father by failing in high school. The father then shifted all of his hopes to the patient who became his whole life. Mr. B. never felt close to his mother who had a limited education and whose chief interest is her home. A maternal uncle is an alcoholic and gambler, another maternal uncle suffered from what was called shell shock during World War I. A paternal aunt is a drug addict and severe alcoholic. Three paternal uncles have had very successful professional careers. The father is ashamed of his wife's family and never mentions his alcoholic sister. He had a tremor of the hands for many years and died in 1946, a year after the patient had been discharged from treatment.

The patient recalled that he had become tremulous soon after he had started masturbating at the age of 12. The tremor of his hands had gradually increased so that from 13 to 22 years of age he had avoided using his right hand. In 1942, when he was 23, it was necessary to hospitalize the patient for 5 months because of excessive alcoholism, his fear that he might kill himself, and the increased frequency of the anxiety attacks. After leaving the hospital the patient was able to stop drinking but his tension, tremulousness and moodiness persisted. There was no change in the clinical picture during the following year. In December, 1944, the patient began discussing a girl friend whom he hoped to marry. The following clinical material was obtained during weekly hypnotic interviews from December, 1944, to May, 1945 (remarks in italics are those of the physician):

December 2, 1944—"My father meant absolutely nothing to me until I was 12. About the same time I started to shake and backed down from contacts with people, from then on I was tied to him. . . . I realize how much I was dependent on my folks . . . telling my girl I loved her was the first thing I ever did for myself in my life. . . . I was ashamed of my folks. I resented my father walking around in the nude. I hated him for that." *For what?* "Because my mother was being lowered by being in the same house. I hated him for that. I wasn't able to accept sex as normal so I had to blame my father. . . . Sex is almost like having intercourse with my mother. . . . For some reason I always loved my father more than my mother. She played a secondary part in my life. He loved my mother and didn't love me. By God, I can say I hate him for that too. Sex is dirty because my father has sex. It had to be dirty otherwise he was expressing his true love to my mother. I could never stand that. He was my whole world as long as I couldn't love anyone else. He loved me in every way but sex. (Weeps) I never could possess him all of the way. . . ."

On January 20, 1945, 6th hypnotic interview—The patient sat down and before anything was said closed his eyes, breathing heavily, and immediately entered the trance state. He then said, "The first thing that

comes to my mind is that I didn't want to do this." *You don't have to.* "I know that. I think I went too far last week—that brings up there is no turning back." *You don't like that, and you didn't like me.* "In fact I hated you for that. *If you hated me how much more should you hate?* "My old man! He dumped me out in the cold world. It's plain that I hated somebody an awful long time. I needed his love because I hated him so terribly. I had to be good. I had to pretend. **Yet he always treated me better than I ever could ask for.** Right now I don't feel any hate. I hate you more. It comes to one point—for many years **I've held on to my father. I hated him because he wouldn't take me back,** but I wouldn't admit it; I knew I never could come back like I was before, which made me hate him even more. I am not pleasing you—for the first time I am pleasing me." *That means?* "Plenty—for many years I had to please my folks, my boss, everyone else but me. I had no soul. I had no mind. I know I can't go back (to things as they were) and I am glad. But I am damn scared." (Later) "I hate my father (cries). I really do, that terrible hate, that terrible attachment I had for him has been done for myself because I worked it out that way, because I can't believe it myself; this is awful hard to admit; I had to work it out that way to be a little kid. I think that's why I hated my girl for awhile; she was threatening my child-like status. I can't possibly lose the tremor. If I lose that I'll lose the feeling of failure and justification I wanted to hold on to since I was 12 years old."

The patient continued, "My father shook ever since I can remember. I wanted tremendously to be like him. My father was a success, he had political influence, a good job. But he was ill-tempered as the devil. My father shook; he did O.K. I thought why can't I shake and do O.K. too. (Rubs his nose) That's very funny. I used a mannerism. It is what my father always does. That proves it. It's awfully hard to say it. It must be; I wanted his approval. I wasn't anybody. I know I had to shake. If I had to pick out anyone to be like, it would have to be him. It fell down because I am not he. If I were he I would have no life —no life at all! I've never been alive. It's hard—awfully hard to be alive." *You are becoming your own self.* The patient repeated the sentence and added, "I will begin to live my own life. I know it will make me happy."

On January 27 the patient began: "When you said I never could say 'No', I never believed you. Now I feel I never was able to be anybody. I never could accept myself as I was. **I only acted like I thought other people wanted me to be.** I never could take myself as just Bill, just me . . . I wonder if I haven't been trying to be more my father than me. God, you couldn't be two people . . . I think I am a pretty good guy and there is no reason for me to be anyone else but me." The patient went on to say that he had worn his honorary fraternity key for the first time in several years. "I was scared to wear it before. Because if I wore it I had to live up to it and I couldn't before."

February 17, 1945, (two months after hypnotherapy was started) the patient reported that he had stopped shaking while in a group for the first time since the age of 12. He went on to say, "I was timid as a kid. When I first started to shake I was ashamed of it. When I noticed my parents were sympathetic it was an added wedge for me to get more love so they would hold me closer. I just wanted one thing, that was to be a kid (weeps). I never wanted to think of my accomplishments; and I wanted you to like me very much." *Because?* "Maybe if you liked me very much, you'd let me hold on to my crutch longer." *That's exactly the way you treated* ——? "That's exactly the way I treated my father. I never could admit I did it myself. That's a hell of a thing to admit, but I really was scared to death to get well."

The patient concluded the hypnotic session on February 17 (11th session) with an account of a dream that he had on the previous night: "I dreamed last night I had splinters in my hand and they were choking me. I was dying; finally I got rid of the splinters and behind the splinters was a pencil—not mine but my father's. It was like I coughed it up, then I wasn't choking. I wasn't dying anymore." The patient went on: "The splinters in my hands which got in my mouth and crippled me was my tremor; it's my father's writing; when he writes he shakes like hell. It seems like it's the part of him I've had trouble throwing off (laughs). I really feel like throwing it off for once." *What is that part?* "I don't know (laughs). I think of his penis—the most important part of a person. I had my father in every other way; that's what I wanted. I wanted him entirely all the way—companionship wasn't enough. The sex urge is an awful powerful urge; if I didn't have him that way I didn't really have him at all. This just comes right out. The only way he could ever express his urge with me was with my mouth. It doesn't make any sense but it's there."

The patient became restless and was asked if he wanted to open his eyes. He did and was told that he could discuss the topic while fully alert. He then went on to say that as long as he was "wedded" to his father that his contemplated marriage was an impossibility, adding, "It feels awful tough to throw what was once an extremely important relationship out of the window. The reason is I am scared to get well. I am scared to death to really and truly be me. I couldn't stand on my own two feet as an individual and like myself for what I am. To me this is just appalling!"

March 17, 1945, (15th session) the patient could report that for the past three weeks he had not experienced his previous "terrific shaking periods." He now stated: "I needed my father because I didn't have a mind of my own." *That means?* "Being spontaneous, doing what you feel like doing, not because you have to or ought to."

On May 2, 1945, (20th session)—Mr. B. stated, "I now write letters longhand using my right hand without even thinking about it. I hadn't used my right hand since I was 13 years old." He reported that he had given his girl an engagement ring feeling that he "really wanted to be engaged." During the hypnotic trance he recalled his intense guilt feelings at the time he first began to masturbate. He remembered how "horrible he had felt after masturbating since it occurred on the day that his paternal uncle had died." It was soon after this that his tremor began. The patient went on to say, "I never really hated my father. He never responded when I needed him. As soon as I amounted to something, I felt I had lost the only person whom I thought I could depend on. I always was a scared guy. I couldn't admit I was. **People don't boss you around. I let them boss me around.** When you admit you're scared you don't feel so bad. **There is not much necessity talking about my father and me anymore.** You see that's it; a fellow would rather be a failure than admit he is nervous and scared, plenty scared (laughs). That struck me funny; when I admit I am scared. I don't shake."

Following this interview on July 14, 1945, (21st session), the patient stated that he now preferred talking things over without being "relaxed." He spoke of his plans to marry in September, 1945, and became aware for the first time in many years that he again was "enjoying hearing the birds sing." The interviews, which had decreased to one every two weeks by this time, now became more irregular and occurred only when the patient felt that they were necessary.

Mr. B. was interviewed in September, 1945, (25th session, two days before he was married). He stated, "I feel perfectly swell. I never shake anymore." The patient telephoned a month later and said that he was free from anxiety. Mr. B. was interviewed on several occasions during 1950–51, when he came to discuss his sister's mental illness. He now is the father of three children, has continued to be successful professionally, and is socially well-adjusted.

The next patient, in contrast to Mr. B., presented her story in a quiet, matter-of-fact manner. There were no emotional outbursts and no revivification of previous traumatic events.

Florence A. was first seen in 1936, at 18 years of age. She was depressed, anxious, and unable to take a vacation because of her fears of what might happen if she were alone. After 8 ineffective interviews treatment was discontinued. In 1938, just before an older, protective sister was to be married, the patient tried to drown herself in the bathtub. On the day after the wedding she attempted to hang herself. After 8 months in a psychiatric hospital, she continued to feel depressed and frequently spoke of her fear that she would have to return to the hospital. Hypnotherapy was begun in 1944 when the patient was 26 years old.

Miss A. is the youngest of 8 children. A paternal grandfather had a "violent temper;" a paternal aunt had persecutory delusions and has been in a psychiatric hospital for 20 years. A maternal aunt was "very eccentric and died in a poor house." The father "had his father's violent temper and frequently slapped the children." The mother was indulgent and quietly suffered because of the father's fits of anger and lack of consideration. Most of the siblings have had feelings of inferiority and mild depressive illnesses.

The patient had been an apprehensive child, who was afraid of the dark and of being left alone. She never had been able to show any affection and was able to work as a clerk under the protective influence of an older sister who also had been her superior.

Miss A. was readily hypnotized for the first time on November 8, 1944. Following the second hypnotic interview (they occurred once a week) she complained of posthypnotic headache. "Is it natural for me to have a headache? It has happened after each visit and lasted about 5 hours." Miss A. reacted favorably to the suggestion that the headaches would not recur and was reassured that she would not have to return to the hospital.

During the third session she reported, "After my second visit that thought was pushed in back of my mind. I could think of it but I could throw it off. It was a sort of dim feeling and it wasn't important anymore." During the same interview the patient spoke of being "ashamed" to show her feelings. She referred to her father saying, "I am afraid people will hurt me." *Like?* "My father did. When we wanted to play around the house he told us to be quiet. He considered us adults—not children. I always thought I was wrong. He suppressed our feelings." *You are still obeying?* "My father." She was asked to repeat, "I will not be a child. I will be my real self. I will be what I really am."

In the weekly hypnotic interviews which followed, Miss A. repeatedly brought up dreams in which she had returned to the psychiatric hospital and "had the eyes of an insane person." In the dream her older sister would try to persuade her to return to the hospital, but in each dream the patient would ask for the therapist who would either prevent her from being readmitted or remove her from the hospital. In regard to this protective sister the patient said, "She always has done things for me since I was young. She made me feel dependent—like a child. I hoped I could go on depending on her." Miss A. had never been able to enjoy herself as other girls did. She said, "I thought I wouldn't have a good time because I had been a bad girl."

During the 7th hypnotic interview, on December 8, the patient spontaneously recalled how she had avoided meeting people when she was a child; she would hide when the door bell rang and she had "hoped to catch pneumonia by standing near an open window." She went on, "I didn't want to be real well. Then they would ask me to do what I didn't want to do. I always acted like people expected it of me." She had refused to take a shower in school and recalled, "I thought it was a shame to show anyone my body." While in the trance she was told, "Some girls remember touching themselves" and replied, "I remember my second grade teacher scolded me when I put my hand down there. She made me wash my hands. In the shower I was afraid that someone might see that I had handled myself. I remember another time a boy told me (age 8) he'd let me ride his bike if I exposed myself. I was on my way to do it when his mother caught us. When I was married I wondered if I ought to tell my husband that I handled myself." She had continued to masturbate after leaving the hospital until she married, 1940.

Two weeks later, on December 22, (9th session) Miss A. recalled striking her head against the wall while at the hospital (1938) and that since then she frequently had thought that she had a brain tumor. During this interview, she reported that her behavior now was less inhibited, "I do more talking. I don't feel that I am shrinking inwardly. I feel like I have more energy."

During the 11th hypnotic interview, on January 5, 1945, she reported the following dream, "I was having intercourse with my mother." She recalled having had sex relations with her sisters in other dreams. The patient went on to say, "I wanted to show her (my mother) affection. I am playing father's part. Even now I feel I should show my mother more affection. I shrink from this feeling. Even as a child I'd never sleep close to my sister. I never wanted anyone to touch me. It's like doing something wrong." *Like?* "An inter-

course. In the dream I am acting like a man. I felt someone should show them affection. I never showed my feelings. I felt mother would feel that I was taking affection from her. Yet I wanted affection, someone to hold me and be close to me. When I see my child (one year old) get affection from her father, I feel I have been robbed."

At this point the patient was able to bring together her childhood fears of the dark and present fear of being alone and said, "I really was and still am afraid of my father coming in. Yet I wanted him to be affectionate."

During the 13th interview, on January, 1945, she reported a dream that "they were hanging a man in a church. He was dead but I knew he was really alive." The dead man, she said, was her father and added, "He isn't alive to anyone but me. I am still listening to him. He seldom went to church. In the dream he is at rest."

By March 2, (17th session) the patient was able to say, "I feel as though I am as good looking as anyone else; not as ugly as I thought I was. Now I can look a person straight in the eyes. I don't feel self-conscious." The patient discussed her repeated attempts at suicide before entering the hospital and while there. She said, "I wanted everyone to feel sorry for me. I felt I wasn't important and that I had a cancer of the brain and might as well jump out of the window as end up in an insane asylum."

During April, 1945, Miss A. reported that she had been able to criticize others. On May 25 (23rd session), while in the trance state, she recalled dreaming that her father was preparing to have intercourse with her when her mother appeared. The patient said, "I am trying to take my father's affections from my mother. If my father wanted me sexually, he wants me and likes me instead of my mother. I always wanted him to praise me." The frightening dreams of being returned to the mental hospital were being replaced by others in which she told her sister that she didn't belong in a hospital and then would come to the therapist's office. She also reported that her frigidity (1940–45) had been replaced by orgasm and a feeling of "strong affection" for her husband. "Inside of me I got the feeling that someone really cared for me. I dreamed my husband kissed me and I had a feeling of real love for him. I was never able to display affection before."

In May, 1945, the hypnotic interviews were decreased to one every two weeks, and on June 23 (26th session) the patient said, "I feel like I am really alive! I find things more interesting and important to me. Before I wouldn't hurt anyone's feelings; now if I am right I don't give a darn. I used to be afraid to say 'no.' I always wanted somebody to like me. I always used to feel I had to be the best because my father wanted me to be the best, so what was the use of trying."

In the Spring of 1946, the patient moved into a new home but refused to permit her mother to move in with her. She stated, "My mother comes to visit me like she does with my other sisters. She comes when I ask her. I used to wish that she was dead, when I thought I had to keep her all of the time. This time I was able to tell her what I thought was right." Hypnotherapy was terminated on June 20, 1946. (It had begun in November, 1944.) On January 8, 1948, the patient came to inquire about placing her mother in a home for the aged. She reported that there had been occasional brief moody periods and episodes of resentment when she had been "neglected" by her sisters.

A follow-up interview on May 1, 1951 (5 years after treatment), revealed that the patient had been able to stay home alone when her husband had to work out of town for six weeks. She also did not become emotionally disturbed when her only child had an appendectomy (1950). She reported that she had confidence in herself and that she didn't feel insignificant as if no one cared for her. She summed up her basic problem by saying, "Before I waited for someone else to do things for me or decide something for me. Inside I felt just like a kid. Now I feel more like a mature woman."

DISCUSSION

The traditional concept of hypnosis as being a passive, physician-centered technic is no longer in keeping with the facts derived from clinical practice and the change in patient-physician relations which has taken place in our culture during the past fifty years. The hypnotic condition more closely approximates the waking state than it does physiologic sleep. The defenses are not obliterated, the capacity to reflect and synthesize remains un-

impaired and an analysis of transference and resistance is possible in the hypnotic state.[7] The patient, while in the trance state, is very much aware whether he is being "investigated" (a physician-centered goal) or being treated in accordance with his basic characterologic needs. The former futile search for traumatic infantile memories gave many patients an excuse to justify their neurotic behavior and to resist change.[14]

The clinical material which has been presented indicates the value of giving the patient every possible opportunity to express what is going on in his present interpersonal relationships. Alexander, in 1946, emphasized that "the patient is suffering not so much from his memories as from his incapacity to deal with his actual problems of the moment. . . . It is a fallacy to consider an analysis in which the patient brings up much regressive material as more thorough than one primarily centered around the actual life conflict. . . . Having the courage of one's convictions and speaking up in the office for the first time may be the beginning of a profound change in a patient's capacity for self-assertion which has been inhibited by a suppressive home atmosphere in early childhood."

The traditional explanation that hysteria is "determined by a fixation on the genital phase of infantile development with its incestuous attachment"[11] and Ferenczi's statement that "the hysterical character genitalizes everything" can be reformulated from another point of view. The clinical material which has been presented, indicates that the hysterical patient, like many other neurotics, becomes emotionally disorganized and produces regressive material when a dominant person upon whom the patient depends for safety and security threatens to leave or is no longer available. In order to deceive himself in regard to his actual limitations, the hysterical patient utilizes sexual phantasies and frequently refers to his feelings of hostility which are directed toward these significant, dominant persons. **But these are not true sexual cravings or actual feelings of hostility.** They are pseudo-sexual and sham hostile representations based upon the need to discharge tension, to hold on to these supportive, parental figures and the need to possess them completely, hence also sexually, in their wishes and fantasies.

Jung was aware of the sham sexual behavior of his neurotic patients when he stated that "infantile sexuality is not sexuality proper but an unnatural discharge of tensions that belong to quite another province of life. It is an over-emphasized sexuality piled up behind a dam and it shrinks at once to normal proportions as soon as the way to development is opened. It is being caught in the old resentments against parents and relations and in the boring emotional tangles of the family situation which most often brings about the damming up of the energies of life. And it is this stoppage which shows itself unfailingly in that kind of sexuality which is called infantile."

The author has come to similar conclusions in a recent study of a group of sex offenders whose heightened sexual tension could be best explained and effectively treated in terms of frustrated dependent needs of immature, passive individuals who had responded with sham-hostility directed toward dominant, supportive individuals who no longer were available. As Jung had indicated, these patients' over-emphasized sexuality "returned to normal proportions as soon as the way to development was opened." To literally interpret the hysterical patient's incestuous phantasies as being truly sexual is to make the same error

that Freud made in 1896. The hysterical patient is an anxiety-ridden, immature individual, who cannot accept the responsibility for living his own life and finds it necessary to defend himself from becoming aware of his limitations. Alexander has commented that the extremely immature oral dependence of many hysterical patients seems to contradict the generalization that they are further advanced in their psychosexual development than other neurotics.

Hypnotherapy, like every other type of psychotherapy, gives the patient the opportunity "to cease to defend himself and instead confess himself fallible and human" and hence authentic, really himself. This can occur only when the patient feels secure in the therapeutic relationship. **Only then can he face the unpleasant truth that he has not been dominated but that he has sought in every possible way to be dominated.** Similar clinical observations have been reported by Fromm, Sullivan, and Horney. This observation should be contrasted to the frequently repeated statement that the neurotic patient has been intimidated, rejected, or over-indulged by his parents, an assumption which does not take into consideration the patient's active role in the production of a submissive interpersonal relationship which fits his neurotic needs. An example of this *folie à deux* type of clinical error is found in such a recent and otherwise excellent text as Dollard and Miller's *Personality and Psychotherapy*. They cite the case of Mrs. A. who "had spent hours in miserable, frustrated, and hostile descriptions of the oppressive conditions imposed upon her by her foster mother. The therapist was able to point out that although in childhood her mother did not permit her to think for herself now she was expected to think for herself." Alexander in a recent paper, in 1950, also stresses the role of the rejecting-seducing parent without referring to the basic need of the child to be dominated. His concept of the "corrective emotional experience" would seem to include "a suppressive home atmosphere" and to take for granted that the child had been "intimidated" by the parent, and therefore must be treated in "reverse" by the therapist in order to "overcorrect" this alleged original mistreatment.

Hypnotherapy has become a patient-centered, permissive, flexible form of psychotherapy. In our culture this is accomplished by encouraging the patient to think of himself as being a collaborator and as being worthwhile. Whitehorn has emphasized the importance of "shared values and the communicability of value judgment as the basis of the healthy and enthusiastic life of man, an inherent social being." The chief art of every psychotherapist consists in creating an effective interpersonal relationship by means of which the patient can experience his uniqueness and yet feel free to realize his full potentialities. In selected cases, hypnotherapy helps to reduce anxiety by promoting physiological relaxation, by establishing positive transference relations, and by actively helping the patient to accept himself as he actually is without guilt feelings.

Goal-oriented behavior as a motivational force or influence was a significant factor in the recovery of both of the patients. Mr. B. had made the decision to marry ("the first thing I ever did for myself in my life"), and with this goal in sight he was motivated to work through his emotional problems and surrender his previous passive-dependent needs. The second patient had been motivated by her ambivalent threat of having to return to a

psychiatric hospital and the fear of incurable insanity.

From a theoretical point of view, it is probable that "the incorporated image" of the therapist replaces the incorporated and unconscious image of the parental or dominant figure. Kubie and Margolin have concluded, therefore, that "the use of hypnosis in some form may conceivably be necessary for the complete displacement of disturbing super-ego figures which are retained out of childhood."

It is hoped that this paper will contribute to the "increasing tendency to report observations directly in terms of attitudes and conflicts of attitudes in personal relationships." Whitehorn has pointed out that, "By this more direct empirical reporting, freed of excess ideological baggage, intellectual freedom may be gained for the necessary revision of the traditional and outmoded Freudian ideologies and presumed ideologies."

SUMMARY

The clinical data obtained during the hypnotherapy of two hysterical depressed patients are presented in detail. The nature and origin of neurotic hostility and of the sexual phantasies are discussed and the value of formulating the dynamic factors in terms of current interpersonal relationships is contrasted with the use of traditional Freudian explanations. It is concluded that the hypnotic condition more closely approximates that of the waking state and that it can be utilized to foster active patient participation as a collaborative, interpersonal experience.

RESUMEN

Se da cuenta en este trabajo de los datos obtenidos durante la hipnoterapia de dos pacientes histéricos y en estado de depresión. El autor estudia la naturaleza y origen de la hostilidad neurótica y de las fantasías sexuales, y el valor de formular los factores dinámicos en términos de las relaciones interpersonales en contraste con el uso de las tradicionales interpretaciones freudianas.

El autor señala que la hipnoterapia ha hecho posible una forma de psicoterapia, flexible, permisiva y centrada en el paciente. En nuestra cultura esto se logra alentando al paciente a pensar que está siendo un importante colaborador del psiquíatra. El arte principal de cada psicoterapista consiste en crear una relación mutua personal y efectiva, por medio de la cual el paciente se dé cuenta de que él no es un enfermo más, sino el preferido y, sin embargo, que se sienta en libertad de desplegar todas sus potencialidades. En casos especiales, la hipnoterapia ayuda a reducir la ansiedad originando una relajación fisiológica, estableciendo relaciones positivas de transferencia y ayudando activamente al paciente a aceptar su propia personalidad, tal y como es, sin sentimiento de culpa.

RESUME

L'article donne un compte rendu détaillé des observations cliniques relevées au cours de l'hypnothérapie de deux sujets hystériques et déprimés. La nature et l'origine de l'animosité neurotique et des bizarreries sexuelles de ces cas y sont discutées, et l'on y fait également une étude comparative entre la valeur de la formulation des facteurs

dynamiques en fonction des relations interpersonnelles courantes et l'application des explications Freudiennes traditionnelles.

L'auteur fait remarquer que l'hypnothérapie, est devenue une forme souple et acceptable de psychothérapie, centrée sur le sujet. Dans notre culture, cette technique est mise en oeuvre en encourageant le malade à se considérer comme un collaborateur et à reprendre conscience de sa dignité. Tout l'art du psychothérapeute se ramène à créer une relation interpersonnelle efficace par le moyen de laquelle le sujet traité parvient à réaliser son unicité tout en se sentant libre d'utiliser pleinement toutes ses possibilités. Dans certains cas choisis, l'hypnothérapie contribue à l'anxiété en favorisant la détente physiologique, en établissant des relations positives de transfert affectif, et en aidant efficacement le malade à se voir sous son véritable jour et à se débarrasser de sentiments de culpabilité à son égard.

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Electroencephalography and Cerebral Lesions: A Clinical Investigation on Children

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During the years 1949–51, at the Department of Child Psychiatry, University Hospital, Upsala, we have tried to obtain electroencephalographic investigation of every new inpatient. This was done because it became apparent to us that lesions of the brain were of importance in the genesis of neuroses. Annell has recently reported her experiences in this connection[1] and has pointed out that this new aspect opens up new approaches in treatment and, thus, also new ways of influencing the symptoms of the neurotic child. There are a number of earlier papers containing the results of EEG investigations in children with mental disorders.[2, 3, 4, 5, 6] As far as we could discover, these have not always consisted of clinically well-differentiated series of patients, but of groups of certain symptoms or behavior patterns which were then compared with controls. It is self-evident that a sign such as lability or outburst of temper can result from widely differing causes, and, therefore, it must be very difficult to reach any definite conclusions from a comparison between a control series and a group consisting of such different states as are encountered in epileptics, neurotics, and patients with traumatic lesions of the brain, even if they all have lability or outburst of temper in common. Thus, we thought it would be of interest to compare EEG findings with the clinical picture to discover if there was any correlation between them.

METHODS

The somatic part of the investigation consisted of a thorough physical examination. If it was considered desirable, the patient was referred for otological, ophthalmologic, or pediatric opinion. Where a lesion was suspected, the basal metabolism was determined, glucose and water tolerance tests were carried out, and in more serious cases, also, encephalography or examination of the cerebrospinal fluid. In order to detect lesser disturbances of motor coordination, the child's performance of simpler manipulations, articulation, and balance tests was studied and, in the case of school children, reading and writing tests. In certain cases special investigations were made by means of Ozeretsky's motor test which, however, we have not found specially valuable, and in a few others by a method described by Schwab-Prichard:

Dynamometer test—Index finger to thumb as fast as possible—Draw ten circles superimposed upon each other without lifting the pencil; time and spacing noted—Get up from chair as fast as possible; time noted—Walk a measured distance as fast as possible; time is taken—Special writing tests.

In appropriate cases we have, in addition, carried out hormone assays, orthostatic tests, x-ray examinations, etc. The usual routine serologic tests, and blood and urine examinations were carried out.

The psychiatric part of the investigation was based on as complete a history as possible, with information from parents, relatives, the child welfare authority, and school. In the ward, the child was studied in his general behavior and in his ability to mix with other children. At daily meetings the doctors were able to exchange experiences and observations with the psychologist, the specially trained teacher, the play-teacher, the social worker, and the nurses, student nurses, and students. We have tried to have every child investigated psychometrically, using Terman-Merrill's method as the standard. In those cases where this has, for one reason or another, proved unsuitable, Bühler-Hetzer's method or special performance tests have been used. We have tried to test each child three times using the diagnostic sand boxes, and in addition in every case a number of special psychologic tests have been carried out. To elicit slighter specific signs of brain lesions, three special tests have been used.

1. Weigl's sorting test.[8] The equipment consists of 4 squares, 4 circles, 4 equilateral triangles, and 4 rhombi, a red, a yellow, a blue, and a green of each. The patient is asked to arrange the objects in groups each consisting of units with some common characteristic. When this is done, the patient is asked to rearrange them in another way on the same principle. The cases with a lesion have special difficulty in changing over from one system to the other.

2. Marble-board test (Werner-Strauss).[7] Colored marbles are placed in a certain pattern on a board with special hollows and the patient is asked to reproduce this pattern on a similar board. The first board is then removed and the patient is asked to make a drawing of the pattern from his own board. Children with lesions have special difficulty in this test to get a general impression of the design in marbles.

3. A test of purely manipulative character. The patient is asked to place 144 small cubes in specially designed depressions on a four-sided board. With this test it is possible to observe the child's motor functions, sense of direction, side dominance, perseverance, power of concentration, etc., and also information on the consistency of the way of working. Inconsistent methods are found particularly among children with lesions.

Side dominance was tested with the aid of a test battery devised by Trankell.

The final clinical diagnosis was, of course, not determined by the results of a single test. The history, the general impression, and the results of testing, were considered together, and a diagnosis could only be arrived at when a consistent general picture had been formed. A single test, however decided its result, did not effect the clinical diagnosis if the remaining examinations pointed in another direction. In all cases the diagnosis was made by the Head of the Department.[1]

Electroencephalographic examination was carried out with a 6-channel Grass-apparatus. In children under 10, 4 electrodes were used for each hemisphere, and in those over 10, 7 electrodes were used. Only bipolar leads were employed. All EEGs from the investigation period were collected and studied in succession in order to obtain as uniform an assessment as possible; this study was made with no knowledge whatever of the diagnosis. The following were recorded: The alpha-frequency (measured between the occipital electrodes), the incidence of theta- (activity 4–7/sec.) and delta-frequency (activity 2–3/sec.), the number of episodic phenomena, the incidence of spikes and spike-and-wave-production, the incidence of side differences (dominance, asymmetries), and focal episodes. The effect of hyperventilation was included in this investigation. Those curves were considered pathologic in which definite episodic phenomena (series of paroxysmal waves of high ampli-

TABLE I

Diagnosis	*Normal*	*? Normal*	*? Pathologic*	*Pathologic*	*Total*
Total series	43% (115)	23% (60)	17% (46)	17% (46)	267
Neuroses	57% (65)	18% (21)	17% (20)	8% (9)	115
Neuroses without clinical signs of a lesion	61% (60)	18% (17)	12% (12)	9% (9)	98
"Genuine neuroses"	72% (44)	21% (13)	0 (0)	7% (4)	61
Clinical lesions	19% (41)	21% (15)	30% (22)	30% (22)	73
Motor difficulties	27% (25)	17% (16)	28% (26)	28% (26)	93
Special difficulties with reading and writing	32% (12)	15% (5)	41% (15)	13% (3)	35
Neuroses with mainly aggressive symptoms	52% (16)	23% (7)	19% (6)	6% (2)	31
Neuroses with mainly regressive symptoms	64% (25)	10% (4)	18% (7)	8% (3)	39
Feeble minded (I.Q. 65–80)	44% (19)	25% (11)	23% (10)	8% (4)	44
Imbeciles (I.Q. under 65)	25% (5)	20% (4)	20% (4)	35% (7)	20
Psychoses	55% (10)	17% (3)	11% (2)	17% (3)	18

tude, at least 150 MV), spikes, spike-and-wave phenomena, and distinct side-dominance and focal episodes, were found. In certain cases within the age-groups 9–11, certain curves were considered pathological because of an unusually high incidence of low frequencies (2–7/sec. activity). Because the border line between pathologic and nonpathologic is very difficult to determine, especially in children, a number of curves have been marked as probably pathologic (? pathologic); in these cases changes were found in one or more of the above criteria. These were very similar to the pathologic curves. Another group has been marked "? normal," in which some notable, but probably nonpathologic, finding was made. The remaining curves have been marked "normal." No suitable control series were available, and so the different clinical groups had to be compared with each other after they had each been assessed individually. For the sake of convenience the "normal" and "? normal" series have been joined and termed "normal series," in the text; and the "pathologic" and "? pathologic" have been termed "pathologic series." The detailed distribution of cases in our series can be seen in Table I. Finally, comparisons have been made between 2 different clinical groups with respect to alpha-frequency, incidence of episodic phenomena, number of slow waves (2–8/sec.) (estimated to a four degree scale), and the incidence of side dominance or focal changes.

CLINICAL MATERIAL

The cases investigated were all inpatients at the Clinic for Child Psychiatry. Patients have come from all over the country, with possibly more from the counties surrounding Upsala. The proportion of children from country and town districts is representative for the whole country, except that there have been hardly any from the great cities (Stockholm

and Gothenburg). The waiting list is long (up to one year for boys) and for this reason slighter and more transient cases, and less alarming psychiatric disorders, have probably never been admitted. Thus, there has been a certain predominance of the more serious and long drawn out disorders. The waiting time for girls has been considerably shorter, and most on the list have been admitted. In contrast with other child psychiatry clinics in the country, at Upsala insulin coma therapy has been used in the treatment of psychosis; therefore, the psychosis group has possibly been especially large. To avoid the diagnostic difficulties encountered at the age of puberty, this investigation consists of patients up to and including 11 years only. The lower age limit has been fixed at 3 years. The total number of cases completely investigated was 267. In 66 cases EEG examination could not be carried out owing to the patient's lack of cooperation. Clinically, these 66 cases have not differed greatly from the main series but possibly more have shown clinical signs of a lesion. These 66 cases seemed particularly to react with apprehension and agitation at EEG examination. Of the 267 cases, 171 were boys and 96 were girls. The reason for admission has been the manifestation of mental peculiarities or behavior disorders. The cases were as follows:

Neurosis	115 cases	Epileptoid temp.	15 cases
States due to organic brain lesions	58	Neurolability	12
Feeble-minded	44	Psychopaths	9
Mental infantility	36	Endocrine disturbances	6
Dyslexia	35	Aphasia	5
Epilepsy	21	Mutism	4
Imbeciles	20	Mongolism	3
Psychosis	18	Deafness	2
Motor immaturity	18	Deaf-mutism	1

Multiple diagnosis has been made in some cases, and so the total number of diagnoses exceeds the number of patients. Neuroses are defined as mainly psychogenic disorders. Children with certain conditions have of course had a greater tendency to neuroses than normal children. Diagnoses such as feeble-mindedness plus neurosis; dyslexia plus neurosis; or postencephalitic state plus neurosis are often found. Because the child's special problems have not been understood, too much strain has been placed upon him. States due to organic brain lesions consist of such conditions as postencephalitic state, where definite grounds for a lesion and a history of previous illness have been found (40 cases), and also cases with clinical signs of a lesion but no history of such (18 cases). Symptoms of a lesion could, of course, occur in any of the other clinical groups, but in those cases they have not been so predominant that they gave a picture of a lesional state. The same applies to the motor difficulties by which we mean disorders of motor coordination. These have presented themselves as tics or other neurologic signs and, in some cases, loss of skill in performing finer movements. In those cases, 18 in all, where there was a general impairment of coordination with obvious physical signs in the absence of other neurologic signs, the diagnosis

of motor immaturity was made. Ordinary fumbling and clumsiness, etc., were considered as being within normal limits and were counted as motor difficulties. Four cases were referred for consultation in connection with divorce procedures or other environmental conditions, but these showed no psychiatric features. The diagnosis was N.A.D.

RESULTS

On surveying the whole series, it was found that 66 per cent of cases had a normal EEG, and 34 per cent a pathologic EEG.

Of the group diagnosed "neurosis," 115 cases in all, 75 per cent were found to have a normal EEG, and 25 per cent pathologic. Other cases also showed occasional neurotic signs of course, but not sufficient to constitute a neurosis. Of the 115 cases examined, 30 were aged 3–6 years, 39 were 7–9 years, and 46 were 10–11 years. The distribution of normal and pathologic EEGs within these age groups was similar to that of the whole group.

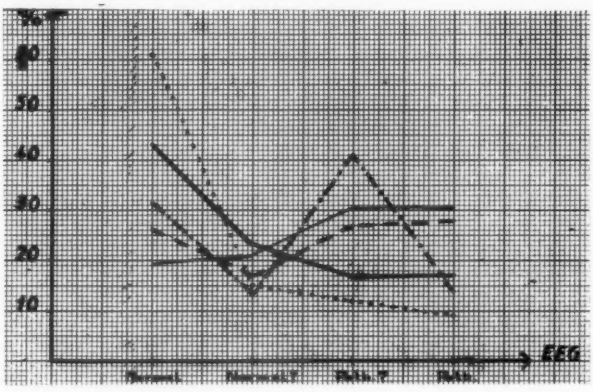
Within the neurosis group, 17 cases showing clinical signs of a lesion were found. When these might have been the cause of the pathologic EEG, they were excluded from the investigation. Thus, a clinical group "neurosis without clinical signs of a lesion" was obtained. This group showed 79 per cent normal EEGs and 21 per cent pathologic.

We then looked for special factors which could be the cause of an abnormal EEG. It was found that of the 21 in the group with pathologic EEGs, 9 had motor difficulties, 4 had special difficulties with reading and writing, and 4 had both motor difficulties and difficulties with reading and writing. These signs seemed to occur often among cases with pathologic EEGs. Comparing those 79 cases in the group with a normal EEG, it was found that 11 had motor difficulties, 7 had special difficulties with reading and writing, and 2 had both these signs. Motor difficulties occur 3.7 times oftener in cases with a pathologic EEG than in those with a normal EEG, and special difficulties with reading and writing 3.3 times oftener. The question arose: Are motor difficulties and special difficulties with reading and writing caused by a lesion? Then we selected all cases showing definite signs of a lesion, and of these, 73 cases in all, 47.95 per cent had motor difficulties, while in the rest of the series these occurred in only 29.99 per cent of cases. The difference is significant ($X^2 > X^2_{.01}$; i.e., $P < .01$). In the series motor difficulties occurred oftener in children with clinical signs of a lesion than in those without. This implies that motor difficulties and special difficulties with reading and writing which are often correlated with them are caused by a lesion.

All cases showing signs of a lesion, all with motor difficulties, and all with special difficulties with reading and writing, were then collected and the EEGs of each group were studied. It was found that in the respective groups 60 per cent, 56 per cent, and 54 per cent were pathologic. This similar distribution implies that both motor difficulties and special difficulties with reading and writing are caused by a lesion. (Figure 1.)

It is particularly interesting that pathologic EEGs are often found in children with special difficulties with reading and writing. Some cases were typical constitutional forms of dyslexia, but most were special difficulties with reading and writing caused by lesions. The commonest signs were poor general motor function with tight gripping of the pencil

and irregular writing. During writing, much accompanying movement of the face and the other hand was seen, there was poor sense of direction with a tendency to transposition, and a lack of fluency in speech and writing. In these cases, poor acoustic discrimination was often found, with frequent confusion of similar vowel sounds. In a few cases it was possible to detect central hearing defects with the audiogram. In our opinion, these cases of special difficulties with reading and writing have passed unnoticed quite often. Children



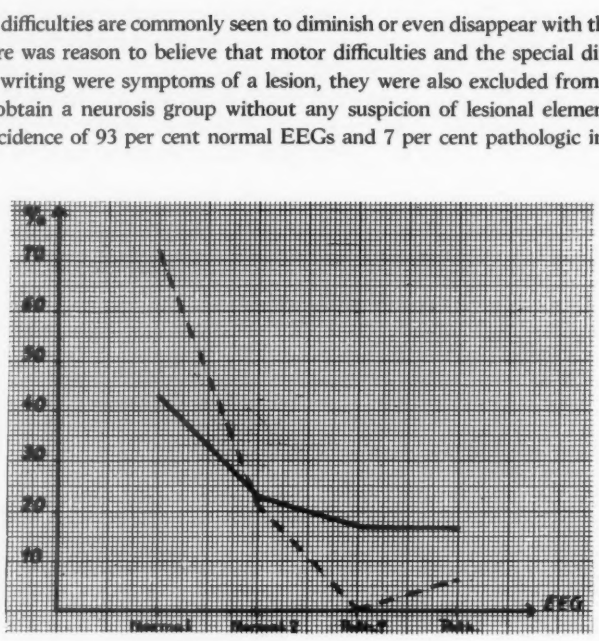
Total series
Clinical lesions
Motor difficulties
Special difficulties with reading and writing
Neuroses without clinical signs of a lesion

FIGURE 1.

with symptoms due to lesions usually do not have the same intellectual and mental resources as children of the constitutional dyslexia type. Usually they have a generally affected mental state with some lowering of the level of intelligence, reduced ability to concentrate, and varying alertness. They tire easily, and their attention is readily distracted. Moreover, they have special difficulty in adjusting themselves to the society of the schoolroom. The tempo of dictation writing becomes too great for their poor coordination. The proximity of other children and distracting noises from the rest of the group are particularly disturbing to them, and their poor hearing makes them easily mistake remarks so that they appear inattentive. Whereas children with signs of constitutional dyslexia often receive consideration, which is their due, in the marking of their school work, the writing and reading difficulties of children with lesions frequently pass unnoticed. They are often masked by various behavior disorders. The general appearance of the child is of untidiness, inattentiveness, or general dullness, and is treated as such by the teacher, and further maladaptation results. These children are probably in need of special teaching and consideration in conjunction with medical therapy, even if they are not suited to higher school studies.

Their school difficulties are commonly seen to diminish or even disappear with this treatment.

When there was reason to believe that motor difficulties and the special difficulties with reading and writing were symptoms of a lesion, they were also excluded from the neurosis, in order to obtain a neurosis group without any suspicion of lesional elements. This revealed an incidence of 93 per cent normal EEGs and 7 per cent pathologic in the genuine



Total series
Genuine neuroses

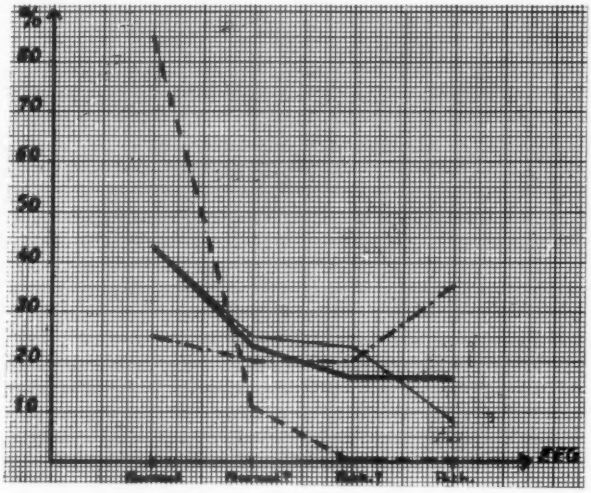
FIGURE 2.

neurosis group. Of the 115 cases originally labelled neurosis, only 61 remained in this group. Almost half the cases were complicated by special factors which made them specially vulnerable to environmental stress. By means of medical treatment, it was possible to help many of the children to withstand these external influences. (Figure 2.)

There are, of course, certain objections to the classification of the EEG result into normal, ? normal, ? pathologic, and pathologic. Three clinical groups were therefore adopted: one consisting of all neuroses, one of all cases with clinical signs of a lesion, and one of all cases with motor difficulties. We compared the alpha-frequencies, the element of slow activity, and the incidence of episodic and asymmetrical activity, between these groups. The alpha-activity showed a strong tendency to lower frequency in the lesion and motor difficulty groups in comparison with the neuroses. There was, however, no significant difference. The element of slow activity was higher in the lesion and motor difficulty groups than in the neuroses, the difference being significant ($X^2 = 5.86$, and 5.604, respectively, with $P < .02$). Episodic activity occurred to more or less the same degree in all groups. On the other hand asymmetrical elements were found oftener in the "lesion" and "motor

difficulty" groups than in the neurosis group. The difference was strongly significant ($X^2 = 12.84$, and 10.54, respectively, with $P < .001$ in both cases). On scrutiny of the EEG curves with reference to the different factors, a difference was thus found between the neurosis group on the one hand and the lesion and motor difficulty groups on the other.

Earlier investigations have shown that patients with lability and a tendency to outbursts of temper are particularly liable to have a pathologic EEG. On dividing the neurosis group into two subgroups, one consisting of cases with mainly aggressive symptoms, and the other of cases with mainly regressive symptoms, it was found that 75 per cent of the



Total series
Psychoses without clinical signs of a lesion
Feeble minded
Imbeciles

FIGURE 3.

aggressive EEGs were normal, 25 per cent pathologic, and 74 per cent of the regressive EEGs were normal and 26 per cent pathologic. Thus pathologic EEGs do not seem to occur more commonly in the aggressive group. Former results can be explained by the fact that they have represented clinically heterogeneous material. Aggressivity and explosiveness as such thus do not seem to be associated particularly often with a pathologic EEG. Within the group with aggressive symptoms, there were 18 boys and 13 girls, and within the regressive group 25 boys and 14 girls. Thus girls occurred in higher percentage in the aggressive group.

The mental defectives were divided into feeble-minded (I.Q. 65–80) and imbeciles (I.Q. <65), consisting of 44 and 20 cases respectively. In the former group, 69 per cent had

normal EEGs, and 31 per cent pathologic, and among the imbeciles the corresponding figures were 45 per cent and 55 per cent. On leaving out those cases showing clinical signs of a lesion, an increase in the percentage of normal EEGs among the feeble-minded was found, no such change occurring among the imbeciles. Thus pathologic EEGs were found more commonly among the uncomplicated imbeciles than the uncomplicated feeble-minded. No distinct difference, however, could be shown, partly because of the small number of cases and partly because signs of lesions are probably easily camouflaged behind the general mental defect of the imbecile.

In the psychosis group, consisting of 18 cases, 73 per cent had a normal EEG, and 37 per cent pathologic. In a number of cases no definite diagnosis could be made, as the clinical picture was nonspecific and variable. On leaving out those cases showing clinical signs of a lesion, the remaining 9 were all found to have a normal EEG.

The remaining groups have been compared but most have either been small or too heterogeneous with regard to other significant factors. In the epilepsy group (21 cases), 86 per cent had a pathologic EEG. All these were clear cases of epilepsy. In the group mental infantility the percentage of normal curves was on the whole the same as that of the total series. (Figure 3.)

SUMMARY

The following conclusions were reached from the investigation:

1. Pathological EEGs occur in greatly increased frequency among cases with clinical signs of a lesion;
2. Motor difficulties and special difficulties with reading and writing, which often occur in association, are usually caused by a lesion;
3. About half the neuroses showed signs of a lesion;
4. The alpha-activity shows a strong tendency to lower frequency among cases with motor difficulties and signs of a lesion than among the cases of neurosis.
5. Elements of slow activity occur more commonly among cases with motor difficulties and signs of a lesion than among the cases of neurosis;
6. Elements of asymmetrical activity occur more commonly among cases with motor difficulties and signs of a lesion than among the cases of neurosis.

RESUMEN

Los autores investigaron minuciosamente a 267 niños con trastornos psiquiátricos, tratando de obtener datos electroencefalográficos en cada caso, por estimar que las lesiones cerebrales son de gran importancia en las génesis de las neurosis. En este trabajo presentan una comparación entre los datos obtenidos por el EEG y el cuadro clínico, y describen la correlación existente entre ambos.

Los pacientes eran de 3 a 11 años de edad: 171 eran niños y 96 niñas. La parte somática de la investigación consistió en un reconocimiento físico completo. Cuando se sospechó la existencia de una lesión, se determinó el metabolismo basal y se llevaron

a cabo las pruebas de tolerancia a la glucosa y el agua, y en los casos más graves, también se realizó la encefalografía o el examen del líquido céfalorraquídeo. A varios pacientes se les hizo objeto de pruebas especiales. La parte psiquiátrica de la investigación se basó en hacer una historia clínica tan completa como fué posible, obtenida de los padres, parientes, autoridades de asistencia social infantil y escuela.

El examen electroencefalográfico se realizó con un aparato de 6 canales Grass. En los niños menores de 10 años se usaron 4 electrodos. Sólo se usaron dirivaciones bipolares. Todos los EEG tomados durante el período de investigación fueron recogidos y estudiados a continuación para obtener una evaluación tan uniforme como fuera posible; este estudio se realizó sin conocimiento alguno del diagnóstico. Al pasar revista a la investigación de la serie completa, se halló que el 63 por ciento tenía un EEG normal y el 34 por ciento un EEG patológico. Sin embargo, en 66 casos no pudieron realizarse los exámenes del EEG por falta de cooperación de los pacientes.

Las conclusiones obtenidas de la investigación, son las siguientes:

(1) Los EEG patológicos se presentan con frecuencia considerablemente aumentados entre los casos con signos clínicos de una lesión.

(2) Las dificultades motoras y especialmente las dificultades en la lectura y escritura, las cuales frecuentemente están asociadas, están usualmente causadas por una lesión.

(3) Alrededor de la mitad de las neurosis mostraron signos de una lesión.

(4) La actividad alfa muestra una fuerte tendencia a una frecuencia más baja entre los casos con dificultades motoras y signos de una lesión, que entre los casos de neurosis.

(5) Los elementos de actividad lenta ocurrieron más comúnmente entre los casos con difficultades motoras y signos de una lesión que entre los casos de neurosis.

(6) Los elementos de actividad asimétrica ocurrieron más comúnmente entre los casos con dificultades motoras y signos de una lesión, que entre los casos de neurosis.

RESUME

Les auteurs ont fait une étude approfondie portant sur 267 enfants souffrant de dérangements psychiatriques. Ils ont essayé d'obtenir une étude électroencéphalographique (EEG) de chaque cas, étant donné qu'ils sont d'avis que les lésions du cerveau jouent un rôle très important dans la genèse des névroses. Le présent article fait une comparaison entre les observations EEG et les constations cliniques, et décrit la corrélation qui existe entre ces deux éléments.

Les sujets étudiés avaient des âges s'échelonnant de 3 à 11 ans: il y avait dans le groupe 171 garçons et 96 filles. La partie somatique de cette étude a consisté en un examen physique approfondi, et dans tous les cas où l'on a soupçonné une lésion, on a déterminé le métabolisme de base et on a effectué des essais de tolérance au glucose et à l'eau; dans les cas reconnus graves, on a procédé en outre à un examen encéphalographique ou examen du liquide cérébro-spinal. D'autres essais spéciaux ont été faits pour divers malades. La partie psychiatrique de l'étude a été faite sur la base d'une documentation aussi complète que possible sur les antécédents commémoratifs des cas

traités, ces renseignements ayant été recueillis auprès des parents, de la parenté, des autorités de protection de l'enfance, et des établissements scolaires.

L'examen électroencéphalographique a été exécuté au moyen d'un appareil Grass à 6 conduits. Pour les enfants de moins de 10 ans, on a utilisé 4 électrodes. On n'a employé que des conducteurs bipolaires. Tous les EEGs obtenus au cours de la période d'étude ont été recueillis et examinés en succession afin de pouvoir faire une évaluation aussi uniforme que possible; cette étude a été effectuée sans avoir aucun renseignement sur les données du diagnostic. En récapitulant les résultats de la série entière, il a été constaté que 66 pour cent du groupe étudié avaient un EEG normal, alors que 34 pour cent accusaient un EEG pathologique. Toutefois, dans 66 cas, on n'a pas pu effectuer d'examen EEG à cause du manque de coopération de la part des malades.

On a tiré de cette étude les conclusions suivantes:

1. Les EEGs pathologiques se rencontrent beaucoup plus fréquemment parmi les cas qui accusent des indices cliniques de lésion;

2. Les difficultés motrices et les difficultés spéciales relatives à la lecture et à l'écriture, qui se présentent souvent associées les unes aux autres, sont en général causées par une lésion;

3. La moitié environ des cas de névrose ont accusé des signes de lésion;

4. L'activité alpha manifeste une tendance marquée à une moindre fréquence parmi les cas présentant des difficultés motrices et des signes de lésion que parmi les cas de névrose;

5. Les éléments de lenteur d'activité se présentent plus fréquemment parmi les cas ayant des difficultés motrices et des signes de lésion que parmi les cas de névrose;

6. Les éléments d'activité asymétrique se rencontrent plus couramment parmi les cas accusant des difficultés motrices et des signes de lésion que parmi les cas de névrose.

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A Psychopathologic Concept of Psychopathic Personality

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Psychopathic personality, ordinarily, is thought of as either a qualitative or quantitative deficiency in the social interaction of the individual. The authors developed their own concept of this clinical entity, and on the basis of this concept performed transorbital lobotomies on 12 psychopaths hospitalized on maximum security wards of the Wyoming State Hospital. Later, six more lobotomies were performed, including some milder cases. Follow-up on the first 12 cases has been more than a year in duration. All but 1 case has improved, so that the patients no longer need maximum security measures. More than half of the cases operated upon are now socially adjusted away from the hospital. Seventeen of the 18 cases have been amenable to retraining; some of these cases will adjust to normal society in the future.

On the basis of these operations, correlated with Minnesota Multiphasic Personality Inventories before and after operation, the authors have objectively confirmed their belief that psychopathic personality cannot be merely a deficiency in the social interaction of the individual, but that the syndrome is a definite and distinct psychopathology of the individual, amounting to a psychosis. If it is presumed that psychopathic personality is a deficiency, the great improvement in these individuals following operation would be an impossibility. Nor do the authors believe that the cause of the syndrome is entirely environmentalistic. Certainly, the environment of the patients in the series was not changed by means of a leucotome. Penological and psychotherapeutic environments, regardless of type or system, will not prevent the great majority of psychopathic criminals from repeating. There is no type of environment that will cure the illness. It might even be said that no certain type of environment will cause the psychopathic personality, for psychopaths come from the most diverse types of environments and home conditions. The most that may be said for environment is that it will shape the type of deviation that the particular affected individual will pursue, modified by the intelligence of the individual and the tendency for psychopaths to seek inferior environments and delinquent companions.

Intelligence is the most stable and constant personality characteristic. Because psychopaths as a group are of normal intelligence or better, it follows that their parents as a group must also be of normal or superior intelligence. It is well known that pecuniary success and social adaptivity are correlated both with each other and with intelligence. Yet, despite this inference, it seems that the majority of delinquents and criminals, most of whom are psychopathic personalities, come from environments in which the financial conditions are well below average, and from environments that are socially inferior. It would

follow that the parents of psychopaths, like their children, are neither culturally or financially successful notwithstanding their intellectual normality. It does not necessarily follow, however, that the homes themselves produce the psychopaths—who frequently have normal and unusually successful siblings—but that the cause of both the home situation and the predisposition to psychopathic personality may be found in the parents. The authors postulate that there is an inherited tendency to psychopathic personality rather than a congenital personality deviation, and that the syndrome develops as the result of environment. The fact that certain mild psychopaths are successful would indicate that a good environment may modify the basic hereditary predisposition, as in other psychoses.

The fact that the psychopath's personality adjustment is a psychosis may be demonstrated by the symptoms, which are indicated by objective, reliable psychological tests, as well as the peculiar bizarre and stereotyped behavior of the affected individuals. Accompanying the psychopathic personality are many other personality maladjustments, which may be either transient and episodic, or chronic and permanent in nature. These consist of paranoid ideas, various neurotic manifestations, affective disorders, and schizoid personalities. Occasionally, a psychopath will become frankly psychotic in the usual sense of the term; this means that the affected individual has two maladies instead of one. More often, however, the traits of other mental disorders will be found to a greater degree than in the normal but in a lesser degree than in the frankly paranoid, neurotic, schizophrenic or otherwise afflcted individual. It is frequently found that psychopaths exhibit subclinical psychoses, such as schizoid traits for example, at an early age and retain these symptoms for many years without a progression of the disease, which in other individuals than psychopaths is a chronic and slowly progressive disorder. It would follow, therefore, that psychopaths either have an immunity to the progression of psychosis in the usual sense of the term, or that the concomitant symptoms of other illnesses are in reality symptoms of the psychopathic personality itself. The latter conclusion seems the more likely, as all observers are unanimous in their opinions that psychopaths are weaker personalities than the normal, and as such should be more rather than less prone to develop psychosis than normal personalities. Following lobotomy, it is noticed that the concomitant symptoms disappear along with the psychopathic personality itself.

Psychopathic personalities are susceptible to environmental stress, but in these individuals the stress is determined by the amount of discomfort to the affected individual. They will go to any extreme to avoid personal discomfort in the immediate environmental situation, although they are incapable of making long range plans for their personal comfort or well-being. Their social misbehavior, which often amounts to crime, is stereotyped in the extreme—so stereotyped that repetition of acts which have previously caused discomfort is common even when it is virtually certain or at least highly probable that the acute discomfort will be repeated. It would almost appear that they are attempting to gain censure for their acts, but when carefully analyzed, this manifestation can be determined as being purely impulsive in nature—an irresistible impulse. It may be further noted that psychopaths do not enjoy their punishment, as would be expected if their motivation were masochistic. They find all punishments and discomforts extremely repugnant

and seek to avoid them. They appear to be less tolerant of pain than normal individuals, and they are extremely reluctant to be confined and will go to almost any lengths to escape either confinement or punishment. If the strong asocial drives are not the result of a neurotic-like masochism in a non-neurotic individual, their cause could be nothing less than psychotic; they are beyond rational explanation. Moreover, the asocial drives are extremely strong in their motivation, so strong that it would appear that they are beyond the control of the affected individual. This cannot be the result of a deficiency in social consciousness, for psychopaths certainly know what the results of their misbehavior will be, especially after their characteristic repeated stereotyped episodes. But it may only serve to prove that psychopaths have quantitatively normal drives and that these drives are so far diverted as the drives that produce irresistible impulses in early schizophrenics or psychotic depressions, for example. Merely because such abnormal deviation in drives is unaccompanied by gross disturbances of consciousness such as delusions or hallucinations, or marked disturbances in affect, does not controvert the fact that the drives are strong, that they are abnormal, and that they are the result of a personality change sufficient in magnitude to be called psychotic. Merely because a person is more of a madman in his actions than in his speech, does not deny psychosis, any more than the fact that a man may be a madman in his thoughts but not in his actions—such as a paranoid individual who is able to work normally for years while actively psychotic. There is no reason to demand that a psychosis must be completely verbalized; a psychosis is a disease of the total personality, not of the intellect alone, and there is nothing in the definition of psychosis which presumes that the intellect must be seriously affected. Moreover, most, if not all, psychopaths have disturbances of affect, empathy, and consciousness, although these may be milder than in other psychoses and more transitory and episodic. One constant symptom of psychosis in psychopaths is pathologic lying; this is an abnormal symptom without rational basis. The authors have reason to believe that these lies are also the result of an irresistible impulse, and they have observed that following lobotomy psychopaths have less of a tendency to this symptom or a complete disappearance of this symptom.

Ordinarily psychopaths learn from experience following lobotomy. One of the author's patients who previously had never held a job for more than a few days, has been working steadily for more than nine months. He had been an assaultive patient, and when this symptom was relieved, he was released. Almost immediately he was sentenced for grand larceny, but the charges were dropped upon his being returned to Wyoming. This was apparently the only lesson he needed, and he is now leading an honest productive life, having learned in one episode what he had never learned previous to lobotomy. The other patients who have left the hospital have better work records than previously. Those who have remained in the hospital have been, with one exception, able to work steadily in hospital tasks over a period of months without environmental difficulty and are constructively cooperating in their endeavors to maintain a good behavior record in order to leave the hospital. With one exception, the patients, who were operated upon, remaining in the hospital no longer were confined on maximum security wards. They have learned that release from the hospital may not be had by violence, riot, or escape, and it is now safe to

have them on other wards because they no longer conspire against or attempt to hurt the attendants. Ten of these patients had been so incorrigible previously that a penal institution could not handle them; they were sent to the state hospital because of persistent violence and/or escaping or attempts to escape.

One objection in earlier years to the classification of psychopathic personality as a psychosis is the fact that it was then thought that psychosis or neurosis did not manifest itself at so early an age as is usual or frequent in psychopathic personality. However, in later years, it has been found that psychosis, particularly schizophrenia, may occur early in childhood and that children may be neurotic at an earlier age than was previously thought possible. These cases have been explained by the degree of hereditary predisposition. Merely because more psychopaths manifest their first illness or premonitory symptoms at an early age does not deny, in the light of modern observation in other mental illnesses, the fact that they are neither social defectives nor products of their environment, for certain psychopaths do not manifest their deficiency until puberty or even later. In the case of those individuals who develop their psychopathic personality in their teens, the authors cannot understand how such deficiency or environmental defect—presuming that it exists—can lie dormant in some cases as many as fifteen years or longer, and then suddenly manifest itself as psychopathic personality. Where has the defect in the person or his environment been in the meantime? It seems much more likely that the onset of the illness occurs at an earlier average age than other psychoses. This is no more unreasonable to suppose than it is to state that schizophrenics develop earlier than manic-depressives or paranoids as a general rule. Moreover, epileptics, frequently, and migraine sufferers, occasionally, develop in practically the same age distributions as do psychopaths; these are commonly thought to be functional disorders either transposed by heredity or attributed to the result of environmental factors affecting hereditarily predisposed individuals.

Frequently it has been presumed that the psychopath's egocentricity is an indication of his arrested personality development; but is not egocentricity generally symptomatic of psychosis? Nearly as frequently it is asserted that psychopaths are incapable of true affection and that their affect is flattened. The authors have observed abundant evidences of affection from psychopaths. Because they hurt those individuals to whom they are affectionate is the result of their irresistible impulses, rather than a congenital poverty of affect or deficiency in empathy. Because they show no genuine sorrow or gratitude, or show them for only short periods is no more a symptom of defect in a psychopath than it is in a hebephrenic or an excited catatonic, or a paranoid who strikes back at his imaginary enemies. Because psychopaths do not blame themselves for their deeds is furthermore sometimes stated as additional evidence of the same fact regarding their affect. This is also no argument. Why should they be to blame if they are psychotic?

In the light of the above stated facts, the authors have concluded that psychopathic personality is a disorder of sufficient magnitude to be termed a psychosis, that it is probably due to environmental stress superimposed on an hereditary tendency, and that this type of environmental stress tends to condition the social manifestations of the syndrome. It is felt that the pathologic lying and abnormal behavior manifested by these individuals are

due to irresistible impulses, and that these impulses are in turn due to an abnormal and stereotyped social manifestation of drives. These individuals are so severely ill mentally that they do not learn from experience when institutionalized. Following transorbital lobotomy, however, they do learn by experience, and can be trained to adjust in society.

RESUMEN

Sobre la base de 18 lobotomías transorbitarias realizadas en 18 pacientes psicopáticos, junto con los datos en las historias clínicas tomadas del Minnesota Multiphasic Personality Inventories, los autores llegaron a la conclusión de que una personalidad psicopática no es meramente una deficiencia cualitativa o cuantitativa en la interacción social del individuo, sino que el síndrome es un manifiesto y definitivo trastorno psicopatológico del individuo que llega a su psicosis. Si una personalidad psicopática, como ordinariamente se cree, fuera una deficiencia, sería imposible esperar que se produjera ninguna mejoría en estos casos, como la notable mejoría observada en 17 de 18 pacientes.

Los autores establecen que existe una tendencia heredada a la personalidad psicopática, más bien que una desviación de la personalidad congénita y que el síndrome se desarrolla como resultado del ambiente.

Los autores llegan a la conclusión de que la personalidad psicopática es un desorden de suficiente magnitud para denominársele psicosis; que probablemente están causadas por las tensiones y esfuerzos de origen ambiental, sobreimpuestas a una tendencia hereditaria, y que dichas tensiones ambientales tienden a condicionar las manifestaciones sociales del síndrome. Se estima que la mentira patológica y la conducta anormal manifestada por estos individuos, son debidas a impulsos irresistibles y éstos a su vez debidos a una anormal y estereotipada manifestación social de sus impulsos. Estos individuos están tan gravemente enfermos mentalmente, que no aprenden como resultado de los datos recibidos por la experiencia, cuando están en una institución para enfermos mentales. Sin embargo, después de la lobotomía transorbitaria, aprenden por la experiencia, y pueden ser adiestrados para vivir en sociedad.

RESUME

Sur la base de 18 lobotomies transorbitales effectuées sur 18 sujets psychopathiques, et à la lumière des renseignements puisés dans les antécédents commémoratifs consignés dans les Répertoires de Minnesota sur les Personnalités à Phases Multiples, les auteurs concluent qu'une personnalité psychopathique n'est pas simplement une déficience qualitative ou quantitative dans la réaction intersociale de l'individu, mais que le syndrome est une psychopathologie distincte et nettement déterminée de l'individu, qui se ramène à une psychose. Si, comme on le croit généralement, une personnalité psychopathique constituait une déficience, il serait alors impossible de s'attendre à une amélioration quelconque de ces cas; en réalité, dans le groupe en question, sur un total de 18 malades, 17 ont accusé une amélioration marquée.

Les auteurs présument qu'il y a dans les personalités psychopathiques une certaine

tendance héritée, plutôt qu'une déviation congénitale de la personnalité, et que le syndrome en question est le résultat de l'influence du milieu.

Un symptôme constant de psychose chez les psychopathes est le mensonge pathologique; c'est un symptôme anormal sans fondement. Les auteurs pensent que ces mensonges sont le résultat d'une impulsion irrésistible, et ils ont observé qu'à la suite de la lobotomie, les psychopathes ont moins tendance à manifester ce symptôme ou même le voient complètement disparaître.

Les auteurs en concluent que la personnalité psychopathique est un dérangement d'une envergure suffisante pour mériter d'être appelée une psychose, qu'elle est probablement due aux tensions du milieu environnant venant s'ajouter à une tendance héréditaire, et que ce type de tension du milieu environnant tend à conditionner les manifestations sociales du syndrome. Les auteurs estiment que le mensonge pathologique et le comportement anormal manifestés par ces individus sont dus à des impulsions irrésistibles, et qu'à leur tour ces impulsions sont dus à une manifestation sociale à la fois anormale et stéréotypée de contraintes. Ces individus sont si dérangés mentalement qu'ils ne peuvent pas apprendre par l'expérience lorsqu'on les place dans une institution. Par contre, après avoir subi une lobotomie transorbitale, ils sont susceptibles d'apprendre par l'expérience et on peut alors leur enseigner à s'ajuster aux conditions de la société.

DISCUSSION

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The behavior of many psychopaths is so inappropriate, self-damaging and inadequately motivated that extreme social maladjustment results. It can scarcely be denied by any observer that this maladjustment, this social disability, is psychotic in degree. I strongly support the authors in their opinion that such psychopaths should be regarded as psychotic despite their excellent powers of abstract reasoning. Darling and Sanddal emphasize a major point in stating that patients who show no signs of psychosis in their verbal performances can nevertheless be psychotic in their actual behavior. If this point can be generally understood and admitted the way will become clear to develop wiser and more practical methods of dealing with the psychopath. It is a point, when thoroughly understood, which reveals what is the most fundamental feature of this puzzling and profound personality disorder.

The reported results of transorbital lobotomy on this group of patients is indeed encouraging. Few other psychiatric disorders result in disability so extreme and so chronic as in some psychopaths; and few in patterns of conduct so socially undesirable and damaging. Though transorbital lobotomy results in some irreversible losses of personality function, the almost hopeless prognosis and severe degree of disability in many of these cases justifies and indicates drastic therapeutic measures.

Carbon Dioxide Inhalation Therapy of Neuroses

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In 1947 Meduna first published a preliminary report[1] of his research in a new pharmacodynamic approach to the treatment of patients with various psychoneurotic conditions. This consisted of administering by inhalation a mixture of 20 per cent carbon dioxide and 80 per cent oxygen, although subsequently he recommended 30 per cent carbon dioxide and 70 per cent oxygen. Meduna stressed, and has continued to stress, that he depends entirely on a pharmacologic approach and purposely avoids utilizing any psychotherapeutic methods in his treatment. Within the limits that such is possible, there being no way to eliminate completely the psychologic aspects of any physical therapeutic procedure, he has managed to demonstrate that the biochemical effects of carbon dioxide inhalations have therapeutic value in a variety of nervous conditions. In a series of 100 patients he reported[2] relief of symptoms in 68 per cent; the diagnosis included such conditions as anxiety states, hysteria, stuttering, and spastic colitis and the like.

Wilcox[3] modified Meduna's approach, combining CO_2 therapy with psychotherapy. He also introduced a technic he termed psychopenetration, in which certain key questions are asked the patient to test the accessibility of the latter's unconscious conflicts.

I have utilized CO_2 therapy as an office procedure, and occasionally as a sanitarium treatment, for over three years, administering a total of approximately 6,200 treatments to 213 patients. The clinical results indicate that while carbon dioxide therapy is beneficial by itself the overall improvement is definitely hastened by correlated psychotherapeutic interviews. On the other hand, a significant proportion of patients whose illness had been quite resistant to psychotherapy alone responded in a gratifying way when CO_2 treatment was added to their program.

INDICATIONS

In the author's experience the psychiatric syndromes which offer the best prognosis with carbon dioxide therapy comprise anxiety states, phobic reactions, some types of character neuroses, and certain ill defined chronic tension states with such symptoms as nervousness, irritability, and a tendency towards explosive outbursts. Also patients with psychosomatic problems such as spastic colitis and migraine headaches often respond very well. Some alcoholic patients in whom psychoneurotic factors are particularly prominent and occasionally a passive type of homosexual patient may show a good response. Individuals with conversion hysteria or with fairly pronounced depressive or schizoid features react less favorably to CO_2 therapy. As may be inferred, the therapeutic effects of CO_2 inhalations are very probably mediated through some fundamental mechanism that cuts across diag-

nostic boundaries, which in psychiatry are rather ill defined anyway. However, in the major psychoses and in firmly established obsessive-compulsive states, CO_2 treatment is usually of no lasting benefit. The primary application of the therapy is to neuroses and psychosomatic conditions.

REQUIREMENTS AND PRECAUTIONS

Meduna has emphasized that this is a safe method of treatment as long as a few basic precautions are observed. In addition to appropriate neuropsychiatric studies, an adequate medical history is taken and physical examination and indicated laboratory tests performed. The principal contraindications to treatment are a significant degree of hypertension or arteriosclerosis, organic heart disease of more than mild degree, active pulmonary tuberculosis, and intracranial lesions such as aneurysm. The author successfully treated a physician's wife throughout pregnancy, and subsequently MacRae[4] reported the use of CO_2 even during the first and second stages of delivery in place of the conventional anesthetics.

TECHNIC

In office practice, the patient lies fully clothed on the treatment table, held by one nurse assistant. Using an anesthesiologist's gas machine, the physician administers 30 per cent carbon dioxide–70 per cent oxygen from a previously prepared mixture. The physician records each inhalation by counting aloud. The author has found it helpful in most cases to facilitate the induction of the carbon dioxide coma by increasing the concentration of the carbon dioxide up to 50 per cent, beginning about the tenth respiration. This is accomplished by adding straight CO_2 to the breathing bag mixture through a Y-tube hookup. Thus, the prepared mixture of 30 per cent carbon dioxide–70 per cent oxygen may flow at 6 liters per minute, while the straight CO_2 is added from a separate tank at the rate of 3 liters per minute.

The author's method, which represents a modification of the technic of Wilcox, permits the patient to reach a deep level of anesthesia without a protracted period of hyperventilation, which many patients find uncomfortable. Usually after 25 to 40 respirations the patient has reached a sufficient level of coma, and the mask is then removed. The author usually carries the inhalation procedure to the point where the patient begins to show fine tremors of the fingers or secondary slowing of respiration.

During the inhalation treatment, the patient may show much restlessness and motor discharge of tensions in addition to his marked hyperpnea. Usually he wakes within 40 to 60 seconds after the mask is removed. The whole inhalation procedure may be administered in approximately 5 to 6 minutes.

After waking he may recall a dream, which sometimes is susceptible to symbolic interpretation. There is rarely any hang-over effect, and after a few minutes rest he is able safely to leave the office unattended. There is great variation in the number of treatments required, anywhere from 10 to 100 being needed for best results. Considering that most

neurotic patients have been sick for from 10 to 30 years or more before reaching the psychiatrist, it is not surprising that a fairly large series of CO_2 comas may be needed to reverse effectively the process of their illness.

In order to facilitate the therapeutic process it is the author's practice in many cases to administer two or more CO_2 treatments during a therapeutic session, allowing about 10 minutes for rest and psychotherapeutic interviewing between the inhalation procedures. This method capitalizes on the greater accessibility of the patient's unconscious material immediately following a CO_2 coma treatment. Such an approach must be based on thorough knowledge and appreciation of the basic psychodynamic mechanisms of the unconscious. Also caution must be used not to push the patient too rapidly when much emotionally charged "material" is rising to the level of awareness.

REACTIONS

During the inhalation of high concentrations of CO_2, a temporary alteration of almost every nervous activity is produced. At first we are apt to find various motor and sensory phenomena, emotional reactions, and beginning changes in consciousness. These may blend into psychomotor excitement as the loss of consciousness deepens. Finally there are characteristic changes in the visceral nervous system. Concomitantly, as the treatment proceeds, the physician easily observes a marked stimulation of the patient's respirations, an increase in heart rate and force of the cardiac systole, usually a rise in blood pressure of 15 to 30 mm., and flushing and hyperhidrosis.

Generally, the observable motor responses follow the pattern described by Gyarfas, Pollock, and Stein.[5] Early in the treatment periocular twitchings are noted. Soon extensor hypertonus appears, though often the upper extremities are in slight flexion. Next comes consecutive transitory plastic tonus, and then increasing rigidity of the occipital muscle groups and opisthotonus. In the still deeper stages there develops a high degree of extensor rigidity in all limbs, with the fingers in the *main d'accoucheur* position and the toes in plantar flexion. No tongue-biting, incontinence, or postconvulsive stupor occurs, in contrast to epileptic seizures and to metrazol or electrically induced fits.

Meduna[6] has classified the physiologic reactions to CO_2 inhalations as follows:

1. The stage of subcortical excitation, lasting from the first few respirations to about the 12th, manifested by increase in respiration, heart rate, blood pressure, and sweating.
2. Cortical inhibition, lasting about 6 to 20 respirations, manifested by loss of contact with the environment.
3. Psychomotor and psychosensory excitation, possibly by stimulation of subcortical centers or by release of these structures from inhibition by the higher centers. These changes may be in the nature of emotional discharges and their character depends on the structure of the patient's personality and illness. These phenomena usually occur after 20 to 40 respirations.
4. Extra-pyramidal and other motor phenomena and subcortical epileptiform

attacks may appear, usually after 30 respirations. These include slight tremors, tetanoid spasms of the hands, athetoid movements, and rigidity, first in the flexors and then in the extensor groups. Babinski toe signs are often seen, shortly before decerebrate rigidity and epileptiform fits.

As can be inferred from the foregoing descriptions, there is some blending of one stage into the next. It may be supposed that the effect of these concentrations of CO_2 on the brain is, in general, an inhibition of the higher (cortical) centers and a release of the lower (brain stem) centers. These changes occur in progressive fashion as the patient continues to inhale the CO_2–O_2 mixture. Carried far enough, this eventually results in a pronounced secondary slowing of respiration, due to beginning suppression of medullary functions—a danger signal that demands immediate cessation of that treatment.

Apart from these general changes, there is much variation in the character of response of the individual patient. Some lie rather quietly during the treatment; others thrash around strenuously, sometimes showing "bicycling" or quadrupedal locomotive tendencies. Some patients have vivid sensory perceptions and dreams, whereas quite a few remember nothing after they awake. A sizeable proportion of the patients develop some apprehension about the procedure because of the subjective phenomena produced.

HEALING MECHANISMS OF CO_2 THERAPY: NEUROPHYSIOLOGY AND BIOCHEMISTRY

The theoretical basis for the therapeutic effects of carbon dioxide on nervous disorders has been extensively discussed by Meduna[7] from a neurophysiologic point of view. In this paper an abstract of his theories along with other pertinent data will be presented. It is necessary to consider the problem from two points of view: (a) the effects of CO_2 on the individual nerve cell, and (b) the effects of CO_2 on the nervous net of the central nervous system, with its estimated 10 billion nerve cells.

Much of the basic knowledge of the effects of CO_2 on the individual nerve cells comes from the very extensive experiments of Rafael Lorente de No[8] on the physiology of both frog and mammalian nerves. He states that CO_2 has long been known to produce the following effects upon frog nerves: (1) it raises the threshold of stimulation; (2) it decreases the speed of conduction of impulses; and (3) it increases the height and prolongs the duration of the action potential. Lorente de No has shown that these three effects are all due to the action of CO_2 in raising the membrane potential.[9] In any concentration within the range of 0.5 to 100 per cent, CO_2 produces an increase in the membrane potential, the increment being roughly proportional to the logarithm of the concentration of the gas.

It is worth noting that to submit nerve to the effect of pure CO_2 for considerable periods of time does not result in any demonstrable damage to the nerve.[10] Furthermore, CO_2 has been found to restore the normal excitability of nerves depolarized by the action of veratrine or by a moderate excess of potassium ions. The presence of 5 per cent CO_2 increases the ability of the nerve to perform work, because the enzymatic mechanisms of the nerve utilize stores of metabolic energy more readily or more effectively in the presence than in the absence of a certain concentration of CO_2.[11] Mammalian nerves have been shown to be much more sensitive (i.e., more easily depolarized) than frog nerve by lack of CO_2. This is

perhaps due to the fact that CO_2 has been found to participate in reactions leading to metabolic synthesis within the nerve.[12]

The effects of CO_2 on the brain are closely correlated with those just described on isolated nerve. From the electroencephalographic standpoint, CO_2 first produces a shift to the fast side of the spectrum with decrease in voltage.[13] As the inhalations continue and the patient loses consciousness, high voltage slow waves appear. If the inhalations are carried far enough, the subject goes into deep coma and suppression of cortical activity occurs to the degree that the EEG flattens out almost completely.

According to Himwich,[14] carbon dioxide is the most powerful of the intrinsic regulators of cerebral circulation. One effective operation of this gas may be traced to its synergistic action upon cerebral vasculature and systemic blood pressure either to raise or to lower cerebral blood flow. Inhalation of CO_2 produces a marked cerebral vasodilation and at the same time may cause a generalized systemic vasoconstriction. Kety and Schmidt[15] demonstrated that breathing only 5 to 7 per cent concentrations of CO_2 produces an average increase of 75 per cent in cerebral blood flow.

Pollock et al,[16] in studying the central inhibitory effects of CO_2 in man, report that breathing CO_2–O_2 mixtures "increases cerebral blood flow by dilating cerebral arterioles, increases respiratory rate and so the oxygenation of blood, shifts the hemoglobin dissociation curve so that the blood releases more oxygen to the tissues, and shifts cortical *p*H to the acid side. In the explanation of the central inhibitory action of CO_2 these factors must all be considered." These workers found that 18 patients breathing 15 to 30 per cent CO_2 for only 30 seconds were protected against electrical stimulating currents that otherwise produced convulsions. Their results are consistent with the earlier findings of Gellhorn and co-workers[17] that in intact cats metrazol, picrotoxin, coryamyrtin, absinthe, strychnine, and camphor convulsions were all stopped by inhalation of 15 per cent CO_2, but not by low partial pressures of oxygen.

Otis[18] subjected mice to an environment of 20 per cent CO_2, 21 per cent O_2, and 59 per cent N_2 and found that they will survive for at least a week, but may die if suddenly removed to room air.

Gibbs and Gibbs[19] performed rather extensive studies on the humoral effects of inhalations of 30 per cent CO_2 and 70 per cent oxygen, by drawing blood samples from the internal jugular vein and from the carotid artery of the patients before, during, and after treatments. The results are summarized in the following Table I and explain why cyanosis does not develop in the patients, since the oxygen saturation of both arterial and venous blood increases during the therapeutic inhalations.

Now, from a neurophysiologic point of view, a neurosis may be thought of as a disturbance in homeostasis in which reverberating circuits of a pathologic nature constitute the nuclear problem. In other words, according to such a concept, the organism becomes neurotic after an unsuccessful attempt at adaptation to a series of stressful stimuli A relatively simple example is the chronic state of alarm of the airplane pilot with an anxiety neurosis following a flaming plane crash. For many months after his escape from catastrophe the circuits in his nervous system may continue to reverberate in a nonadaptive way, pro-

ducing the well-known clinical symptoms of sympathetic overactivity, such as palpitation, excessive sweating, disturbed digestion, insomnia, and the like.

In such case then, if we can elevate the threshold of stimulation of the nerve cells involved in these pathologic reverberating circuits, we can break up the circuits and give the homeostatic mechanisms of the nervous system a chance to take over again. Since the immediate effect of the CO_2 lasts only a few minutes, it requires a series of treatments to effect a satisfactory reversal of the pathologic reaction that we call neurosis.

Due to limitations of space, this neurophysiologic theory of the healing mechanisms is presented in an oversimplified way. However, it is in line with certain formulations developed in cybernetics.[20] It should be apparent, moreover, that it is not really incompatible with more orthodox psychologic or psychobiologic theories of neurosis. For example, it is well known by psychiatrists that one of the principal problems of therapy is to bring about an adequate discharge of repressed emotional tensions. In the author's experience, this abreaction is often greatly facilitated by CO_2 inhalations. Thus, even deeply repressed rage may be rather quickly brought to the conscious level, permitting better integration with higher cortical functions such as judgment. Simultaneously this tends to ease the disturbance of visceral function, reflected in symptoms like heart-pounding, headache, disturbed sleep, and various related manifestations. Patients with a constant feeling tone of anxiety or foreboding often notice a progressive decrease in this important aspect of their illness, perhaps without having achieved any particular insight at the conscious level. In general, the more rigid the character structure the more resistant the patient is to CO_2 therapy, but this is likewise true of most other therapies.

In acute tension states various drugs have been used in the last 40 years to bring about emotional catharsis, including light etherization, nitrous oxide, somnoform, hyoscine, and the barbiturates. Of all these, probably intravenous sodium pentothal and sodium amytal have been most effective. However, in the author's experience, none is nearly so effective as carbon dioxide, nor so safe and so easy to administer.

COMBINATION OF CO_2 THERAPY AND PSYCHOTHERAPY

During his several years of research in CO_2 therapy, Meduna carefully avoided any other form of treatment of his patients and thus was able to demonstrate the therapeutic efficacy of CO_2 alone. However, in clinical practice it is always worthwhile to combine this physiochemical approach with modern psychotherapeutic technic. Without going into detail one may mention that CO_2 therapy facilitates treatment by brief analytic methods, through which the experienced therapist may usually uncover rather quickly the infantile trends that generally constitute the core of the neurosis. Immediately following an inhalation treatment, the patient is ordinarily much more accessible and receptive to the therapist's interpretations.

Development of the transference situation is hastened by CO_2 therapy, and both positive and negative phases more easily worked through. Sometimes a patient who is unaware of his hostile feelings for the therapist is greatly surprised when these rise suddenly to the surface as he emerges from a carbon dioxide coma. Yet, as he regains full consciousness

TABLE I*

Blood Sample	Procedure	O_2 Content		O_2 Saturation		O_2 Capacity	O_2 A-V Difference	CO_2 Content		CO_2 A-V Difference	R.Q.	pH		Sugar		pH A-V Difference	Sugar A-V Difference	Lactic Acid		Lactic A-V Difference
		C. Art.	J. Vein	C. Art.	J. Vein			C. Art.	J. Vein			C. Art.	J. Vein	C. Art.	J. Vein			C. Art.	J. Vein	
		Vols. %		Vols. %		Vols. %	Vols. %	Vols. %						Mgs. %			Mgs. %	Mgs. %		
1	At Rest	19.33	13.43	95.2	66.2	20.31	5.90	48.49	54.11	5.62	.95	7.369	7.318	112	105	.051	7	8.00	8.75	.75
2	5 to 20 Inhalations	20.07	15.69	98.8	77.3	—	4.38	74.09	63.81	−10.28	—	7.055	7.161	—	—	−.106	—	—	8.75	—
3	20 to 35 Inhalations	20.21	17.22	99.5	84.8	—	2.99	80.97	75.50	−5.47	—	6.960	7.025	112	105	−.065	7	8.75	9.50	.75
4	35 plus Inhalations Mixed Mask Off	20.25	17.99	99.7	88.6	—	2.26	83.80	78.87	−4.93	—	6.941	6.959	113	105	−.018	8	8.25	9.00	.75
5	Immediately After	19.81	16.95	97.5	83.5	—	2.86	47.53	60.30	12.77	4.46	7.354	7.188	—	—	+.166	—	—	10.25	—
6	10 Minutes After	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	13.75	—
7	15 Minutes After	19.99	14.48	98.4	71.3	—	5.51	45.96	51.27	5.31	.964	—	—	—	—	—	—	—	14.50	—

* From L. J. Meduna: CARBON DIOXIDE THERAPY. Courtesy of Charles C Thomas, Publisher, Springfield, Illinois.

30 to 40 seconds later, he retains sufficient memory of these negative feelings to be able to discuss them with much therapeutic gain with the physician. Occasionally the patient becomes flooded with a rush of hitherto buried feelings that disturb him considerably. At such times the therapist may find it advisable to give him another treatment in short order to dissipate this particular reaction. As skill in the technic develops, it becomes possible to achieve therapeutic gains of a fundamental nature that equal or surpass those of the painfully slow and protracted psychoanalytic technics of traditional procedures.

The question arises whether carbon dioxide therapy is suitable for use by the general practitioner as well as by the psychiatrist. The answer seems to be yes, if the general physician has some knowledge of psychiatric principles and more than average interest in the problems of psychiatric patients. The treatment should not be given as purely a mechanical procedure, and in the author's experience the complications that have arisen have been of a psychiatric nature rather than a purely physical kind. In other words, some of the patients have shown at certain stages of the treatment a marked increase in anxiety and tension, and this development requires most careful management. In the case of three patients with such a reaction it was necessary to institute a mild form of electrocoma therapy to avert a possible psychotic breakdown.

RESULTS

The evaluation of degree of clinical response in the case of psychiatric patients, the vast majority of whom are suffering from chronic illness of many years' duration, is admittedly not too satisfactory. The following analysis of results of treatment represents the first 66 patients treated by the author with carbon dioxide therapy. About one-fourth of the patients had been under psychotherapeutic management for several months before being started on the inhalation treatment. For purposes of classification of results the patients are divided into 3 groups: Much Improved—26 patients, or 39 per cent; Improved—28 patients, or 43 per cent; and Unimproved—12 patients, or 18 per cent. Criteria for classification of "Much Improved" included complete or nearly complete disappearance of symptoms, significant increase in capacity for functioning at work and at home, and adequate insight by the patient of the nature of his problem. Criteria for labeling the patient "Improved" included at least 50 per cent reduction in severity of symptoms, significant improvement in feeling tone, and some insight as to the nature of the problem. In the "Unimproved" group were listed those patients who either did not show a satisfactory response or did not maintain their improvement. This included two depressed patients who later responded quite satisfactorily to electroshock therapy. Interestingly enough, several of the patients showed a favorable response in terms of one condition (e.g., migraine headache), whereas the response for some other concurrent condition (e.g., phobic reaction) was less favorable or unsatisfactory.

The results analyzed in Table II are based on a follow-up period of 18 months to 2 years. Subsequently treated patients seem to fit into a very similar pattern and to show a very comparable degree of therapeutic success.

TABLE II

NOSOLOGIC GROUPS	Much Improved	Improved	Unimproved	Range in No. Treatments	Median Average No. Treatments
Anxiety Neuroses and Phobic Reactions					
32 patients	13	17	2	8 to 130	18.5
Character Neuroses					
18 patients	9	6	3	4 to 53	16.5
Psychosomatic Reactions					
8 patients	3	4	1	8 to 42	18
Alcoholics					
7 patients	4	2	1	8 to 20	10
Homosexuals					
3 patients		1	2	16 to 45	16
Depressive Reactions					
2 patients			2	11 to 34	23
Conversion Hysterias					
4 patients	1	2	1	8 to 15	9

It will be noted that patients with anxiety states and phobic reactions showed a generally good response, as did those with character neuroses. The alcoholic patients included in the 4th category were those with a rather prominent degree of neurosis, usually of the anxiety type. The small group of homosexual patients showed improvement in some of their emotional tensions but not too much change in the basic psychosexual makeup. The small group of patients with conversion hysteria did not respond too well, which supports the inference that the effects of the treatment are not primarily due to suggestion.

Concerning the number of carbon dioxide treatment sessions for the 66 patients, the total was 1886, but many received 2 or occasionally 3 treatments at a session, so that the total number of treatments given was approximately 3,000. It is interesting to note that in comparing the 3 groups, there was surprising uniformity in terms of the number of CO_2 treatment sessions. Thus, in the 32 patients in the "Much Improved" class, the number of treatments varied from 8 to 130 with a median average of 17. In the group of 28 patients classified as "Improved," the number of treatments varied from 4 to 86 with a median average of 17.5. In the 12 patients classified in the "Unimproved" group, the number of inhalation sessions varied from 8 to 42 with a median average of 16. The fact that some patients made an excellent response with as few as 8 treatments and others required 70 or 80 treatments before showing a sustained improvement of equal degree indicates the tremendous variability of response to carbon dioxide therapy and emphasizes the need for adequate treatment. In private practice it is often difficult to get the patient to follow through with a somewhat unpleasant therapeutic procedure as he begins to feel pretty well, even though the physician realizes that his improvement would be further consolidated by more therapy. A total of 9 patients discontinued the inhalation procedure after only one or two treatments, because of apprehension.

ILLUSTRATIVE CASES

No. 1: A 36 year old accountant was stricken with attacks of pain in the left chest, trouble in getting his breath, weakness, and faintness. When hospitalized he was told at first that he had pericarditis. The electrocardiogram showed a conduction defect of the bundle branch block type. However, serial ECG studies revealed a stationary lesion, and the conduction defect was attributed by the cardiologist to childhood diphtheria. Diagnosis was then made of severe anxiety state, and the patient sent home from the hospital, after being given reassurance and sedation. However, in the next 3 weeks his anxiety level remained very high, and the pulmotor squad was called by his wife on two occasions to revive him from an attack.

This set of circumstances led to referral of the patient as a psychiatric emergency. When first examined, he was obviously tense and apprehensive and hyperventilated in a noticeable way, complaining of severe precordial pain. Evaluation of the psychosomatic history revealed a longstanding anxiety tension state dating back to childhood. As an officer aboard ship during the war, he suffered a moderate breakdown of function, requiring several weeks' sick leave but no psychiatric hospitalization.

Because of his fulminating anxiety state, no prolonged or detailed investigation of his early background was then undertaken. One interview was spent in a careful explanation of the physiologic origin of his symptoms and their connection with his emotional state. Then, with the concurrence of the cardiologist, the patient was started on carbon dioxide inhalation therapy. He was given 35 respirations of the mixture the first time, reaching a light coma and then showing a moderate abreaction of tension. Following that he felt more relaxed than he had in 3 months, he reported.

The patient was continued on CO_2 therapy at a frequency of twice a week for 4 weeks and then once a week thereafter. Psychotherapy was confined to brief explanation and re-education, no attempt being made in this case to probe the deeper levels. In light of the severity of his illness, the patient showed very rapid progress toward health, being able to return to work two weeks after psychiatric treatment was instituted. By the end of three months he was largely symptom-free. Under the stress of a difficult job situation, a mild exacerbation of his anxiety occurred, but this responded to continuation of the CO_2 therapy. By the end of six months of treatment, once a week, he reported that he felt he had largely conquered his tensions and was adjusting much better to his work and to his home situation. A very interesting sidelight was his later report that he had had no migraine headaches since two weeks after starting CO_2 treatment, although previously he had had them 3 to 4 times a week since very early childhood. He stated that he had not mentioned the migraine attacks to the therapist in the beginning, because he had long ago decided that nothing could be done for them, after unsuccessfully trying all the usual measures.

Case No. 2: A 30 year old married woman was overcome at her work as a bookkeeper in May, 1947 with a spell of faintness, palpitation, great fear, and allied symptoms. From that time on, she had a phobia of being alone and of losing her mind. She was subject to frequent attacks of anxiety and great weakness and crying spells. In addition, she had suffered for many years from headaches, which were worse just before her menstrual periods.

The usual medical studies were not particularly productive, and examination by a consulting neurologist revealed no organic disease of the nervous system. She was then advised by the latter specialist that she was simply a very sensitive person and would have to adjust to her sensitivity or adjust her sensitivity to her environment. However, the anxiety attacks, the phobic reactions, and the headaches all grew progressively worse.

Accordingly, she was referred by her family physician for psychiatric evaluation in May, 1950—three years after the initial onset of florid symptoms. The anamnesis revealed a long-standing lack of self-sufficiency, previously concealed by an exaggerated outward independence and rebelliousness toward family domination. The headaches were found to be of two distinct types: (1) unilateral headaches with vasomotor disturbances, partly related to premenstrual tension; (2) headaches of the diffuse pressure variety over the vertex, signifying a conversion symptom of the unconscious wish to "blow her top."

The patient proved receptive to the initial formulation of her problem as being one of repressed emotional tensions, especially resentment, and of associated disturbances of bodily function. She was then started at once on carbon dioxide inhalation therapy. The first treatment, with 30 respirations, produced only a very

light coma but released so much emotional tension that she almost immediately began to tremble rather violently and burst into tears. It was necessary to give her a sedative before she could leave the office. However, the next day she felt much better and one week later, on her next interview, reported she was a bit less tense. CO_2 therapy was continued at the frequency of once a week, but it was necessary to administer only light reactions because of the patient's grave apprehension about "losing control." In the conjunctive psychotherapy the physician helped the patient analyze the feelings underlying her fear of "losing her mind" and the repressed wish to lash out with anger at people around her. (It is well known by psychiatrists that in the case of phobic reactions the patient's ego strength is generally quite weak, and the patient has a strong fear of being overwhelmed by his or her own impulses.)

Despite her fear of the CO_2 treatments (or rather her fear of the painful feelings that they brought to the surface), the patient was persuaded to continue, partly by reason of the relatively rapid improvement she could realize that she was making. Much repressed rage was brought to the surface, where it could be satisfactorily analyzed and dissipated. Her anxiety was proportionately reduced and likewise her fear of being alone, which of course represented a fear of loss of control. Also the patient soon learned to recognize her vertex headaches as being an index of some resentment fairly close to the surface, which could usually be made to disappear by application of some of the new insights she had gained.

At the end of 5 months the patient showed a great improvement in her interpersonal relationships as well as in her phobic reactions and pressure headaches. The unilateral migrainous headaches were also about 50 per cent better. (In this connection, it is interesting to note that a CO_2 treatment will usually relieve a preexisting tension headache, based on spasm of the scalp muscle and the suboccipital muscle groups, but a vascular headache is apt to be temporarily aggravated, due to the vasodilating effect of carbon dioxide.) After 9 months of treatment, the migrainous headaches had likewise been relieved, and the patient had been promoted to a better job. Rather characteristically, although the patient had not had an anxiety attack for 4 months, she still had a mild fear at times that she might get one again. In other words, the psychoneurotic patient has to get used to the changes in the internal environment, and in such cases this after-anxiety can usually be successfully relieved by further CO_2 therapy, which was done in this patient's case.

SUMMARY

In the author's experience, carbon dioxide inhalation therapy produces favorable effects in many anxiety states and phobic reactions, some character neuroses, certain psychosomatic conditions like spastic colitis and migraine headaches, and some alcoholic problems. It is usually very desirable to utilize psychotherapy in close conjunction with this neurophysiologic treatment.

The neurophysiologic action of CO_2 on the nerve cell is to raise the membrane potential, which in turn raises the threshold of stimulation of the nerve, decreases the speed of conduction of impulses, and increases the height and prolongs the duration of the action potential. The central effects of carbon dioxide include a marked increase of cerebral blood flow, increase in the respiratory rate and oxygenation of the blood, and a shift of the cortical *p*H to the acid side. In general, CO_2 first inhibits the higher (cortical) centers and releases the lower (brain stem) centers. Secondarily, the latter are inhibited in progressive fashion, in reverse order of their phylogenetic development.

The healing mechanisms of CO_2 therapy are not too clearly understood but probably involve a breaking up of pathologic reverberating circuits in the nervous system, thereby allowing the homeostatic mechanisms of the organism to take over again. In addition, emotional tensions are released and unconscious material becomes more accessible, facilitating the psychotherapeutic process.

JOHN D. MORIARTY

Over a 3 year period a total of approximately 6,200 carbon dioxide treatments have been administered by the author to a total of 213 patients. The results in the first 66 patients are herein analyzed in some detail and seem representative of the total group of 213. In the series of 66 patients, including 7 nosologic groups, the overall results were: 26 patients or 39 per cent, were classified as "Much Improved;" 28 patients or 43 per cent, as "Improved;" and 12 patients or 18 per cent, as "Unimproved."

RESUMEN

Según la experiencia del autor, el tratamiento con inhalaciones de anhidrido carbónico, produce efectos favorables en muchos estados de ansiedad y reacciones fóbicas, en algunas neurosis del carácter, en ciertos procesos psicosomáticos como la colitis espástica y las migrañas y en algunos problemas del alcoholismo. Es usualmente muy recomendable unir estrechamente la psicoterapia con el tratamiento neurofisiológico.

La acción neurofisiológica del CO_2 sobre la célula nerviosa aumenta el potencial de la membrana, que a su vez aumenta el umbral de estimulación del nervio, reduce la velocidad de conducción de los impulsos y aumenta la altura y prolonga la duración de la acción potencial. Los efectos centrales del anhidrido carbónico, incluyen un marcado aumento de la corriente sanguínea en el cerebro, velocidad de la respiración y oxigenación de la sangre y una desviación ácida del pH cortical. En general el CO_2 inhibe primero los centros (corticales) superiores y deja en libertad los centros (neuroeje) inferiores. Secundariamente estos últimos son inhibidos de modo progresivo, en orden inverso a su desarrollo filogenético.

Los mecanismos curativos de la terapia por el CO_2 no se conocen claramente, pero es probable que entrañen una ruptura de los circuítos patológicos reverberantes en el sistema nervioso, permitiendo así que los mecanismos homeostáticos orgánicos vuelvan a adquirir su función rectora. Además, se liberan las tensiones emocionales y el material inconsciente se hace más accesible, facilitando el curso de la psicoterapia.

Durante un período de tres años, se han administrado por el autor un total, aproximadamente, de 6.200 tratamientos con anhidrido carbónico a un total de 213 pacientes. Los resultados en los primeros 66 pacientes se analizan con detalle y parecen ser representativos del grupo total de 213 pacientes. En la serie de los 66 pacientes, están incluidos 7 grupos nosológicos, cuyos resultados fueron: 26 pacientes o sea el 39 por ciento, clasificados de "muy mejorados"; 28 pacientes o sea el 43 por ciento, de "mejorados", y 12 pacientes o sea el 18 por ciento, de "no mejorados".

RESUME

Selon les observations faites par l'auteur, la thérapeutique par inhalation d'anhydride carbonique produit des effets favorables dans de nombreux cas d'état d'anxiété et de réactions phobiques, certains cas de névroses de caractère, certaines manifestations psychosomatiques telles que la côlite spasmodique et les maux de tête de migraine, et

certains problèmes d'alcoolisme. Il y a en général grand intérêt à utiliser la psychothérapie en relation étroit avec ce traitement névrophysiologique.

L'action névrophysiologique de CO_2 sur la cellule nerveuse est d'augmenter le potentiel de membrane, qui à son tour augmente le seuil d'excitation du nerf, diminue la vitesse de conduction des impulsions, et, en outre, accroît la hauteur et prolonge la durée du potentiel d'action. Les effets centraux de l'anhydride carbonique comprennent une augmentation marquée de la circulation sanguine cérébrale, une accélération de la cadence respiratoire et de l'oxygénation du sang, et un déplacement du pH cortical vers le côté acide. En général, CO_2 inhibe d'abord les centres (corticaux) supérieurs et détend les centres (de prolongement célébral) inférieurs. En second lieu, ces derniers sont inhibés d'une manière progressive, dans l'ordre inverse de leur développement phylogénétique.

Les mécanismes curatifs de la thérapeutique à CO_2 ne sont pas encore parfaitement connus, mais ils comportent vraisemblablement une rupture des circuits réverbérants pathologiques du système nerveux, ce qui permet aux mécanismes homéostatiques de l'organisme de refonctionner normalement. En outre, des tensions émotives sont libérées et les éléments de l'inconscient deviennent plus accessibles, ce qui facilite le processus psychothérapeutique.

Au cours d'une période de 3 ans, l'auteur a administré un total d'environ 6.200 traitements à l'anhydride carbonique à un nombre total de 213 malades. L'article donne une analyse assez détaillée des résultats observés pour les 66 premiers sujets traités, résultats qui peuvent être considérés comme représentatifs du groupe total de 213 sujets. Dans la série de 66 malades, qui comprenait 7 groupes nosologiques, les résultats d'ensemble ont été les suivants: 26 malades, soit 39 pour cent, ont été classés comme "très améliorés"; 28 malades, soit 43 pour cent, comme "améliorés", et 12 malades, soit 18 pour cent, comme "non améliorés."

DISCUSSION

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Dr. Moriarty's work is of great interest, especially since he evidently uses the carbon dioxide anesthesia extensively for abreaction. In this practice he follows the steps of Dr. William Sargant of England, who stated at the First International Psychiatric Congress in Paris that he found carbon dioxide even more effective for abreaction than the usual barbiturate procedures.

I agree with both Moriarty and Sargant in that ether, nitrous oxide, hyoscine, and the barbiturates are not nearly as effective as carbon dioxide, nor are they as safe and as easy to administer. If the carbon dioxide had only this advantage its use would be justified. An added advantage, however, is its use as a therapeutic measure, which emerges in Moriarty's work wherein he connects the CO_2 treatment with analytical methods. Psychiatrists

working with this method should heed Dr. Moriarty's warning that anxiety and tension may increase during the treatment and this development requires more careful management.

If any other warning is necessary to those administering CO_2, I would formulate it thus: "In anxiety and tension cases, I would rather give less carbon dioxide than too great an amount."

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Psychopathology of Learning and Habituation

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THE DISTURBANCE OF LEARNING PROCESSES

The learning process is essential for the transition of the individual from the phase of innate, primitive, absolute, and immediate responses to the phase of acquired, personally motivated, and mediate habits, i.e., habits oriented more with reference to the future than by present experience. We know that all learning based on imitation, information, or observation may be conceived as a contrast process of formation, differentiation, and extinction of conditioned reflexes, guided by the pragmatic law of success or failure. Those responses which result in satisfaction of a given need become fixed, and those that fail in this purpose tend to be eliminated. Depending upon the individual's evolutive stage and environment, he must adapt to certain exigencies and pursue certain goals. The technics by which he achieves this adjustment are fundamentally those of the learning process. We shall now see how this process may be disturbed in its various manifestations. It will not be difficult to trace its pathogenic development as it encounters obstacles, becomes disorganized, or entirely ceases.

In the first place, a learning process may be disturbed through alteration of its motivation, i.e., its impelling urge (conscious or unconscious); secondly, it may be disturbed due to the absence of the environmental conditions necessary to its expression; thirdly, by leading to results contrary to those foreseen or desired; in the fourth place, there may be temporary or permanent lack of the aptitudes (instrumental resources) by which it is conditioned; fifthly, by being negatively affected by retroactive inhibition; and sixthly, when the individual is exposed to the disintegrating action of intense and persistent emotional conflicts. In the first case, the results are apathy and indifference which negatively motivate the process of habit formation and fixation. The subject does not learn, because he is not interested or will not learn. In the second case, the *occasion* is lacking, and, therefore, there is no constellation of stimuli necessary to set the process in motion; or else the stimuli are present, but are not strong enough. In the third case, a disorganization of patterns occurs, giving rise to a growing sense of frustration and a negative attitude toward the situation with consequent dissolution of response cliches already formed. In the fourth (observed in cases of neurologic changes brought about by pathologic processes), new connections, which insure the progress of the learning process, cannot be established. In the fifth case, such connections are not able to persist, because intervening learning processes orient the action tendencies along new lines and give rise to inhibition of synapses previously open, causing a blackout or the forgetting of things formerly learned. Finally, in the sixth and last case, dissolution takes place on the upper levels, where the adjustment or reinforcement of conduct is controlled and supervised (analogous to the feed back

mechanism of electronic machines), and regression ensues with reappearance of the primary agents of response.

In all these cases, it may be observed that the individual's responses are no longer in line with the requirements of his environment, and, consequently, friction will result between him and his social group, which will consider him as maladjusted and will seek to direct and control his acts—either directly, or through legal action, social or psychiatric aid (in any of its forms, i.e., from the mildest: psychotherapeutic aid, to the most compulsory: commitment to a mental institution).

PSYCHOPATHOLOGY OF IMITATIVE LEARNING

Imitative learning may be altered in two ways: by excess or deficiency. In the first, the subject is a veritable imitating monkey and seeks to reproduce everything he sees or hears, generally, in relation to one or several other persons or animals, although he may also take as his models machines or other moving objects. The motivation for this hyperimitativeness may be, indiscriminately, an identification with the being or object imitated, a tendency to submit to it completely, or, contrarily, an urge to reduce it to the level of the imitator. This happens when children, playing in the street, hide behind some other person and reproduce his gestures and movements. Frequently such is the case among patients with manic syndromes, although they not only imitate, but ever caricature the persons around them. Another reason for excessive imitativeness might be simply the lack of creative ability, such is the case in plagiarism which is so common to authors (both literary and scientific). In such instances, the reader is transformed into the author simply by copying the original. Proof that he is aware of his own insufficiency lies in the fact that rarely will he confess the extent of his plagiarism. He usually copies and quotes the real author, *pedem litteram* for a while and then continues further (with slight transpositions or modifications of verbal expression) but without the proper acknowledgment. This exaggerated imitative process is of tremendous importance in the adoption of certain aims, objectives, and styles of life by many adolescents, and it is not infrequently a factor of prime importance in their progressive failure in life, because they pay no attention to the sensible maxim of Pindarus: "Be yourself."

The reverse case, the inability to imitate, may also result from various causes: excessive self-assertion, lack of reproductive resources in the original patterns, divergence of attitude and purpose with relation to the object imitated or even lack of confidence in success, and fear of the consequences of the imitation. Nevertheless, when the situation is such as to require or even impose imitation, and the imitation is not achieved, nor even attempted, we must interpret this as an oppositional, negativistic, aggressive, or hostile tendency toward the model of the behaviour to be imitated.

A special case of imitative psychopathology is the imitation of homologous actions, i.e., the propensity to *iterative* repetition of a sequence of acts leading to its transformation into an automatism. Freud asserted that such repetition is based on an iterative impulse, probably responsible for the propensity to rigidity of habits in compulsive personalities. We might add that the auto-imitative tendency is pathologic only when it persists in spite of changes

in the situation and in the nature of the responses required. Otherwise it is no more than the objective manifestation of a trait common to all living beings [and particularly those with a neural spine]—which is responding to the present with the reaction that took place in a homologous situation in the past. It is because of this trait that patterns of conduct may be facilitated and stabilized, and the benefits of experience accumulated. But if this is not complemented and balanced by the ability to reorganize such homologous situations, life becomes routine and the individual becomes a reflex machine, or in other words, a psychic corpse. Such is the case with those persons so exaggeratedly autoimitative that we can safely foretell their conduct in any given situation if we were previously able to observe them in a similar situation. They tend toward that "heaviness" or "viscosity" usual not only in compulsives, but also in many mild schizophrenics (affected by so-called "mannerisms"), mental defectives, and epileptics. They all lack that fluidity and that creativity which saves normal individuals from slipping into excess of routine.

PSYCHOPATHOLOGY OF LEARNING BY TRIAL AND ERROR

The trial and error process is the most frequent form of learning in adults. It also constitutes the basis for foresight, or intuition (insight), with the only difference that in the latter the trials and errors are implicit, and carried out in the imagination in a very short period of time. The progress of such maturation may be naturally disturbed by causes identical with those capable of disturbing the imitative type, but other more purely intellectual factors are involved, which are also capable of altering it. First of all, lack of imagination to plan the "trial," i.e., to construct the response pattern for the "attempt" to adapt to the problem posed.

How many persons faced with a new situation request information, or wait to observe the conduct of others because they cannot think of anything! They are not ashamed to confess: "I don't know what to do about this." If, under such conditions no one turns up they can imitate, they are capable of applying a completely absurd and inadequate response pattern. And this is not always due to a lack of interest or determination to succeed, but simply to the absence of an adequate response scheme. Such a scheme should be produced naturally, motivated by the need for a solution of the problem faced and immediately submitted by individual judgment to previous evaluation as to its probabilities of success, which gives rise to the series of operations typical of the intelligent response. If the individual judges such probabilities to be sufficient—and this may occur in a fraction of a second—he will hasten to put the scheme into effect, i.e., to try it out experimentally. This gives rise to possible reasons for altering this type of maturation, to wit: (1) lack of schemes of hypotheses to be tried out (paucity of configuration, or creative imagination); (2) excessive pessimism in a priori criticism (which leads to inaction); (3) lack of control over the scheme (due to excessive self-confidence), leading to attempts doomed to failure, which might otherwise be avoided. In all of these cases, elements of the three levels of personal activity (intellective, affective, and conative) are brought into play to determine the relative or absolute transitory or permanent *inefficiency* of the individual faced with

a problem of learning. Such an individual is generically termed slow and is considered as lacking in intelligence. But the psychopathologist must probe deeper and seek to determine whether failure is due to lack of imaginative (intuitive), controlling (reflexive or critical), or executive (practical) capacity. The latter must also be taken into consideration as affecting learning, as in many instances the desired result is not achieved for lack of adjustment between the response scheme devised and the pattern followed in its execution. Thus we arrive at the following classification of the causes for failure in the *learning process:* (a) Actual intellectual defect (various modes of oligonoia: lack of imagination, incomprehension, or inability to reflect; in its turn, this may be due to retarded mental development: oligophrenia; to a transitory weakening of intellectual power: stupor, dementia, oneirophrenia, etc.; or to mental regression: dementia). (b) *Emotional* disturbance, distorting the sense of values which serves to convince the individual beforehand of the futility and uselessness of his attempt (where frivolous optimism is involved, learning errors result like those found in paranoiac and manic cases; where inhibition and excessive self-control are involved, we get depression and restraint cases). (c) Change in psychomotive integration (dullness of expression or inability to carry things through: dysphasias, dyspraxias, dysrythmias).

To sum up, there is practically no type of mental disturbance which does not in some way affect the capacity to integrate, retain, and carry out the learning process by the trial and error method. It is precisely this method which, when applied to cultural or implicitly speculative problems requiring chiefly abstraction and theoretical reasoning, is first effected and sounds the alarm in demential and organic processes. The so-called "intellectual decay" tests (measurement of the loss of intellectual output) are the surest means for early diagnosis.

PSYCHOPATHOLOGY OF THE RETENTION OF LEARNING

Here we confront material for study usually described under the heading of memory disturbances. Dynamic modern psychology has amply demonstrated, however, the advisability of dispensing so far as possible with terms which might lead to consideration of the existence of elementary and simple deviations in the totality and functional unity of personal activity. Therefore, there is no purpose in retaining the notion of memory—as it was previously understood—to designate a supposed ability to remember, independently susceptible to impairment, as so many patients of specialists maintain: "Doctor, the only thing I suffer from is loss of memory." This is usually the opening remark, but very soon it becomes apparent that the patient has either lost nothing, or he has lost more than he realizes.

It is known that a wide variety of factors influence the retention of vital learning processes. The most stable of these and the least susceptible to weakening or loss is precisely the tenacity of modifications brought about by the effect of an external or internal stimulus on a nerve center or network. But what people ordinarily call memory is not this capacity to retain, but *the ability to recall the original impression,* i.e., the *reproduction of the effect* in the absence of the stimulus. The result of this *re-presentation* is appropriately termed

representation or *mnemonic image*. And the act during which the individual's energy is concentrated in the effort to achieve it is called *evocation*.

We can scarcely conceive of an act requiring greater personal tension than this evocative effort. All the functional resources of the individuality participate in it, and for this reason it can only be maintained for a few seconds, and gives rise immediately to a feeling of ill-being and fatigue if the desired result is not obtained. Under ordinary conditions the reproduction surges up spontaneously, as soon as associative reduction instinctively stimulates the nerve circuits and centers involved in the configuration (pattern) learned, but it may also take place when it is not needed or may remain hidden when it is most anxiously sought. In both cases the use of the learning process is impaired (in the first case by liberation; in the second by representative retention), and these ailments are still known as hyperamnesia and amnesia respectively. When an unwanted representation obstinately fixes itself in the consciousness and the efforts to remove it prove fruitless, an *obsession* results; and when it is actually evoked, but with insufficient clarity, we are faced with hypoamnesia. Finally, if it undergoes an unidentifiable transformation, in such a way that we mistake its identity, the resultant disturbance is designated as paramnesia or pseudomemory.

RESUMEN

El proceso de aprendizaje es esencial para la transición del individuo de la fase innata a la adquirida. Sabemos que todo aprendizaje basado en la imitación, información u observación puede ser concebido como un proceso de contraste de formación, diferenciación y extinción de los reflejos condicionados, guiado por la ley del éxito o el fracaso.

El individuo tiene que adaptarse a ciertas exigencias y proponerse ciertos objetivos, y las técnicas por las cuales consigue estos propósitos son fundamentalmente las del proceso de aprendizaje.

Un proceso de aprendizaje puede ser perturbado en virtud de la alteración de sus causas; por la falta de un ambiente con las condiciones necesarias para su expresión; por predominar resultados contrarios a los previstos o deseados; puede haber falta temporal o permanente en las aptitudes por las cuales está condicionado; por ser afectado negativamente por inhibición retroactiva y cuando el individuo está expuesto a una acción desintegrante de intensos y persistentes conflictos emocionales. En todos estos casos de proceso de aprendizaje perturbado, las respuestas del individuo no están muy de acuerdo con los requerimientos de su ambiente y, por lo tanto, surge un choque o fricción entre él y su grupo social.

El aprendizaje imitativo puede ser alterado por exceso o por defecto. El proceso de la prueba y el error, que es la forma más frecuente de enseñanza en los adultos, puede ser alterada por falta de imaginación, pesimismo excesivo o falta de dominio sobre sus designios. Prácticamente no existe un tipo de perturbación mental, que en cierta forma no afecte la capacidad para integrar, retener y llevar a cabo el proceso del aprendizaje por el método de la prueba y el error.

RESUME

Le processus de l'instruction est essentiel pour la transition que doit subir l'individu pour passer de la phase des connaissances innées à la phase des connaissances acquises. On sait que toute instruction fondée sur l'imitation, l'information ou l'observation peut se concevoir comme un processus de contraste caractérisé par le développement, la différenciation et l'extinction de réflexes conditionnés, lequel processus est orienté par la loi du succès ou échec. L'individu doit s'adapter à certaines exigences et poursuivre certains objectifs, et les techniques par lesquelles il réalise cette adaptation sont essentiellement celles du processus de l'instruction.

Le processus de l'instruction peut être dérangé par l'altération de ses mobiles; il peut être dérangé par suite de l'absence des conditions ambiantes nécessaires à son expression; en aboutissant à des résultats contraires à ceux qu'on avait prévus ou désirés; il peut y avoir un manque temporaire ou permanent des aptitudes qui conditionnent ce processus; en étant affecté négativement par suite d'inhibition rétroactive; et finalement lorsque l'individu est exposé à l'effet de désintégration résultant de conflits émotifs intenses et persistants. Dans tous ces cas de perturbation affectant le processus d'instruction, il est évident que les réactions de l'individu ne sont plus en harmonie avec les exigences de son milieu, d'où il résulte un désaccord entre cet individu et le groupe social auquel il appartient.

L'instruction imitative peut être altérée par excés ou par insuffisance. La méthode par tâtonnements, qui est la forme d'instruction la plus fréquente pour les adultes, peut être altérée par suite d'un manque d'imagination, d'un pessimisme excessif ou d'une discipline insuffisante pour mettre en oeuvre les projets établis. Il n'existe pour ainsi dire aucun genre de dérangement mental qui n'affecte pas d'une manière ou d'une autre l'aptitude à intégrer, à retenir et à mettre en pratique le processus d'instruction par la méthode normale qui procède par tâtonnements.

Response to Electroshock Therapy as Evaluated by Mirror Drawing

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One cannot work for long with electroshock therapy without observing changes in integration of the patient where he responds to treatment. These changes are for the most part recorded by clinicians in the progress notes and are expressed by such statements as: "the patient made a good response to treatment," or "the patient experienced a favorable reaction to a course of 12 electroshock treatments."

It is here proposed that such statements not only be used descriptively, but also conceptually. The phrase *response to treatment* considered as a term would denote a change in the ecological situation of a particular individual and might be considered as a prognostic sign in evaluating the outcome of a particular therapeutic attempt.

It is held that in order for there to be a change in the ecological situation of an organism, the organism must have the capacity to be stimulated and must be presented with an adequate stimulus.

Electroshock is considered to be a stimulus to which the organism may or may not respond, and the capacity to respond or to be stimulated is held to be firmly anchored in the genetic pattern of the organism. Remission or improvement following electroshock therapy would imply that electroshock was an adequate stimulus for the production of a change in the ecological situation of the individual. Failure to be stimulated, however, would imply that electroshock was not an adequate stimulus for that individual.

Recent studies of schizophrenia strongly suggest that schizophrenics do not have the same reactivity or responsivity to stress as do normal individuals. In such studies, Pincus and Hoagland[5] maintain that stress in normal individuals increases the adrenocortical hormone output, while schizophrenics show a striking inability to respond to stress with increased adrenal cortical activity. It may therefore be postulated that schizophrenics who show clinical improvement following electroshock would show increased adrenocortical activity. Several experiments in the literature suggest that there is an association between clinical improvement and increased adrenal cortical activity. Other experiments differentiate schizophrenics from normal individuals in terms of homeostatic functions, i.e., hypoglycemia, etc.

Among schizophrenics there is, of course, variation as to responsivity. The clinician is interested in such variations as responsivity to stress, treatment, etc. There are several approaches to the problem of evaluation of responsivity to treatment. Von Braunmühl[1]

Read in part at the Thirteenth International Congress of Psychology, Stockholm, July, 1951.

suggests that before the full course of insulin coma therapy is begun, the patient be given four electroshocks. Where the patient fails to respond to these four electroshocks by clinical improvement, the prognosis is considered to be poor, no matter how extensive the insulin coma therapy. While it is quite true that many cases fail to respond to electroshock but respond to insulin coma therapy, or vice versa, making von Braunmühl's criteria for predicting the outcome of treatment subject to criticism, these cases suggest the hypothesis that electroshock and insulin coma therapies do not represent the same stimulus for the organism. According to this hypothesis, the individual who fails to respond to electroshock may respond to lobotomy. In such a case, lobotomy would be the adequate stimulus while electroshock would not be an adequate stimulus.

If von Braunmühl's recommendations are followed, evaluation of change following the four convulsions is of the utmost importance, and technics to confirm the clinical evaluation of change should be developed.

In a previous paper Vinson[7] suggested the possibility of evaluating psychobiological integration by mirror drawing and suggested that this technic might be used in the evaluation of changes associated with lobotomy, electroshock, and insulin coma therapies. The following study was undertaken to give more exhaustive treatment to this idea.

HYPOTHESES

1. It is possible to assess the sensorium by the Mirror Drawing test.
2. It is possible to infer response to treatment from the change in the sensorium as evaluated by the Mirror Drawing test.
3. It is possible to predict the clinical prognosis from responses to treatment as evaluated by the Mirror Drawing test.

POPULATION

The population in this study consists of 18 adult patients admitted to the University of Texas Medical Branch for treatment. Of these patients, equally divided as to number of admissions and sex, 10 were diagnosed as schizophrenic reactions, 6 as thymergastic reactions (psychotic depressions), and 2 as anxiety states with depressive features.

METHODS OF TESTING

1. Apparatus:

The design used in the Mirror Drawing tests consists of eight points to be connected serially, indirectly visible in a mirror. The first and second points present maximum difficulty; the third fourth, and seventh, minimum difficulty; and the fifth and sixth, intermediate difficulty. The points or stations are arranged in such a way that there are three sets of angles of similar degrees, and each pair of angles requires orientation in opposite directions (Fig. 1). Although there are several mirror drawing apparatus available, I prefer to use a 4 x 6 inch mirror held in the hand with the elbow touching the table. This technic offers the possibility of making observations about the patient's

behavior in the test situation. Non-compliance with the test instructions, bizarre postures, etc., are brought out by this technic.

2. Administration:

The patient is given a practice period, without the mirror, allowing him to connect the points of the design which are numbered. He is then told that he is to do the same thing while looking into a mirror. This is demonstrated. He is told that he may find it more difficult than without the mirror. If he shows failure at the first station he is

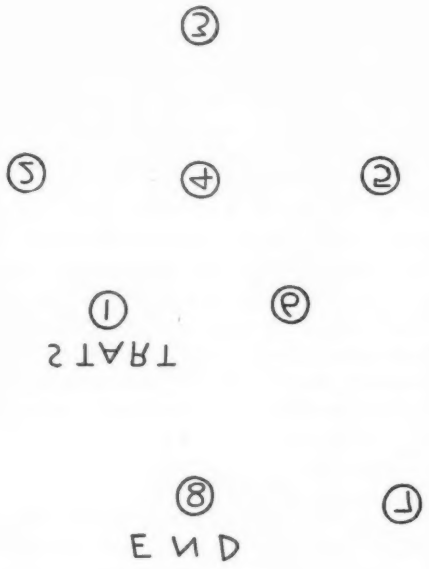


FIGURE 1.

told that many fail. A time limit of two minutes is given for the completion of the test.

Each patient was examined with a battery of tests, one of which was the Mirror Drawing test, prior to treatment, and re-tested each week-end throughout this course of treatment. In all but a few cases there was an interval of two days between the last electroshock and the Mirror Drawing re-test examination. If the patient became *organic*, the original battery of tests was repeated. The term *organic* is used to describe disorganized behavior which may be manifested by extreme agitation, hallucinations, and other abnormal behavior patterns *not characteristic* of the patient's behavior observed at other times. This reaction is held to be the phenomenon described by Sakel[6] as the "activation of a psychosis." According to Sakel, this phenomenon is seen in

patients who have reacted to insulin coma therapy by a display of hallucinations, delusions, etc. It is noteworthy that he reports this reaction in patients who are undergoing insulin coma therapy, for since this reaction occurs in both electroshock and insulin coma therapies, it cannot be maintained that the phenomenon is exclusively associated with insulin coma therapy. Müller,[3] reporting on this reaction, supports the hypothesis that this response to therapy may be regarded as an organic reaction.

3. Scoring:

The performance on the Mirror Drawing test is classified into the following categories:

4 gross impairment
3 marked impairment
2 impairment
1 borderline impairment
0 within normal limits

Clinical evaluation of the patient is made on admission by staff conference, the patient being classified as follows:

4 disturbed and disoriented
3 disoriented as to time or place
2 oriented but confused
1 oriented—slightly confused
0 oriented—not confused

Clinical evaluation of the patient during treatment is recorded in the progress notes by nurses and attending pyschiatrists, with special care taken to note whether the patient shows the so-called organic reaction. On discharge, the patient is reevaluated by the attending psychiatrist, being again classified as to orientation, response to treatment, and prognosis. His prognosis is classified as:

favorable
unfavorable

With regard to prognosis, it will be recalled that Bleuler recommends the formulation of a short-term and a long-term (i.e., after five years) prognosis for schizophrenic patients. As a five year follow-up of these patients is next to impossible, one will have to be content for the present with the short-term prognosis, and to interpolate from studies showing the association between short-term and long-term prognoses how many of the patients, given a favorable short-term prognosis, have had relapses after discharge.

TESTS OF SIGNIFICANCE AND CONCLUSIONS

Tests of significance were performed and the following conclusions were reached:

1. It is possible to assess the sensorium by the Mirror Drawing tests.

   a. The correlation, expressed by the coefficient of correlation, between clinical evaluation of the sensorium and performance on the Mirror Drawing test on admission

indicates highly significant agreement (r was found to be +0.73, significant at the 1.0% level).

b. The correlation, expressed by the coefficient of correlation, between clinical evaluation of the sensorium and performance on the Mirror Drawing test on discharge indicates highly significant agreement (r was found to be +0.706, significant at the 1% level).

2. It is possible to infer response to treatment from the change in the sensorium as evaluated by the Mirror Drawing test.

a. The correlation, expressed by the coefficient of correlation, between the clinical quantitative and mirror drawing quantitative change in the sensorium indicates highly significant agreement (r was found to be +0.72, significant at the 1% level).

3. It is possible to predict the clinical prognosis by the evaluation of response to treatment.

a. The correlation, calculated by the χ^2 technic, between clinical response to treatment and clinical prognosis indicates highly significant agreement (χ^2 was found to be 13.36, significant at the 0.1% level).

b. The correlation, calculated by the χ^2 technic, between clinical prognosis and mirror drawing response to treatment, indicates highly significant agreement (χ^2 was found to be 6.15, significant at the 2% level).

OBSERVATIONS

On admission, the patient's mirror drawing is very often grossly impaired, or impaired, while on discharge, if the patient has responded to treatment, the performance is altered and almost always improved. The trend toward improvement is, in most cases, from a grossly impaired to an impaired, or from an impaired to borderline, although in some cases the record on discharge is within normal limits. Patients who do not respond to treatment show minimal modification of their performance on the Mirror Drawing test. The following records show the typical performance of patients responding and failing to respond to electroshock therapy (Fig. 2).

The statistical evaluation of the data showed that 50% of the patients treated with electroshock became *organic* (to some degree) during their course of treatment. Although some patients showed these changes after the 6th shock, the majority of the patients became *organic* between the 10th and 12th electroshock. It was conclusively demonstrated that when the patient became so agitated that seclusion was necessary, gross impairment on the Mirror Drawing test was demonstrated.

Where there was steady improvement, manifested by increased interest in personal appearance, sociability, co-operativeness, etc., it was found that improved performance on the Mirror Drawing test was demonstrated.

The following table shows the response of the 18 patients to electroshock, when classified by diagnosis.

Schizophrenic Reaction Paranoid Catatonic		Schizophrenic Reaction Simple Hebephrenic		Thymergastic Reaction (Psychotic Depression)		Psychoneurosis Anxiety State with Depressive Features		
Response	No Response	Response	No Response	Response	No Response	Response	No Response	
5	0	2	3	6	0	0	2	18

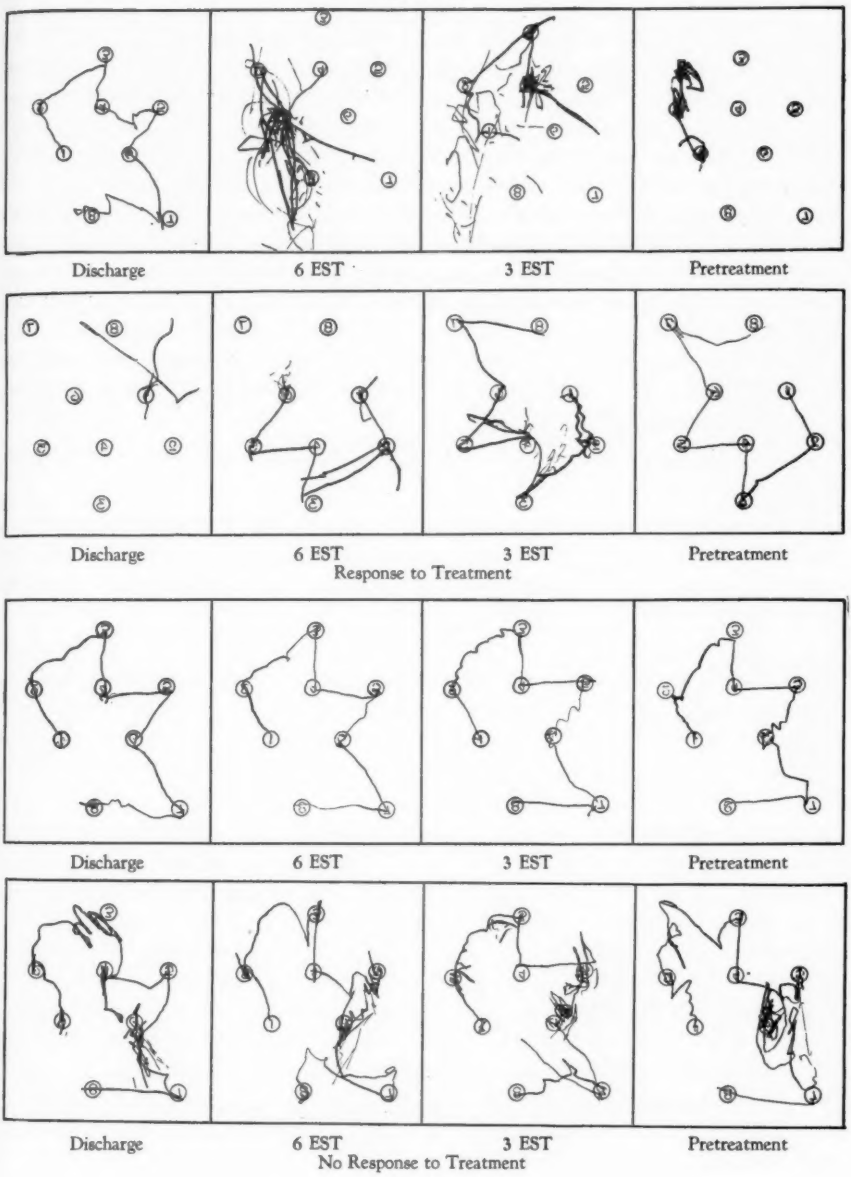
Although there is insufficient data with which to compare patients who gave an organic reaction to treatment with patients who show steady improvement without becoming organic, there is a strong suggestion that there is no significant difference between these two responses to treatment. Thus, it may be hypothesized that the patient need not be "treated to the point of complete disorientation and confusion," in order to respond to electroshock therapy.

COMMENTS

The use of the Mirror Drawing test seems justified in that it provides the clinician with an easily administered technic which may be included in the mental status examination of the patient. In the hospital it has been found to be particularly useful in answering the question: *Has the patient undergone any change, or reacted in any way, to treatment?*

The fact that changes on the Mirror Drawing test are strongly associated with clinical improvement is worthy of note since the clinical evaluation of change (improvement) is made by authorities in the field of neuropsychiatry. While such clinicians, drawing upon wide experience, may be better able to evaluate a given case in terms of improvement than it is possible to do using the Mirror Drawing test, the inexperienced clinician cannot be expected to do so. The Mirror Drawing test may, therefore, be expected to serve a useful purpose by reducing the experience gap between clinicians with wide experience and clinicians with limited experience.

FIGURE 2.


Discharge
6 EST
3 EST
Pretreatment
Discharge
6 EST
3 EST
Pretreatment
Response to Treatment
Discharge
6 EST
3 EST
Pretreatment
Discharge
6 EST
3 EST
Pretreatment
No Response to Treatment

THEORETICAL CONSIDERATIONS

In order to test the hypothesis of *response to treatment* as a function of the constitution (in the same way that disease may be considered as a relationship between the individual and the invading organism), the experimental design was repeated with patients undergoing lobotomy, insulin coma, and combined electroshock and insulin coma therapies. Tests of significance were performed in order to determine if the several therapies differed significantly from one another. With regard to changes on the Mirror Drawing test, there was no significant difference between the several therapies. Furthermore, it is impossible to distinguish between the change on the Mirror Drawing test two weeks post-operatively in lobotomy, after 6—12 electroshocks, or after 20—30 insulin comas. This observation is noteworthy since improvement following lobotomy is held by many to be associated with the degeneration of the dorsomedial nucleus of the thalamus (D.M.N.). Since the D.M.N. does not show signs of degeneration until the 6th post-operative week, improved performance on the Mirror Drawing test two weeks post-operatively can not be associated with the degeneration of the D.M.N.

Clinical response to lobotomy appears to be associated not only with the destruction of the D.M N , *but also with the stimulation of the processes which regulate homeostasis.*

If the Mirror Drawing test reflects changes in the so-called homeostatic mechanisms, as it seems to do, it may be hypothesized that patients who do not respond to electroshock in terms of hypoglycemia, stimulation of the sympathetic adrenal system, etc., will demonstrate minimal changes on the Mirror Drawing test.

It may be further hypothesized that both untreated schizophrenics and schizophrenics who do not respond to treatment will show minimal changes between test and re-test examinations, and that there would be no significant difference between the performance of the two groups. While all the data to support this hypothesis has not been evaluated statistically, it may be said as a preliminary report that this hypothesis will be supported.

RECOMMENDATIONS

In order to test the hypothesis that there is a positive correlation between clinical prognosis and *response to treatment,* further studies are indicated. . It is held that an association between clinical prognosis and response to treatment as evaluated by the Mirror Drawing test has been demonstrated. Physiological studies have been reported which evaluate response to treatment in terms of glucose metabolism, adrenal cortical activity, lymphocyte reaction, activity on the electroencephalogram, delta index, etc. It is now necessary to establish correlations between the several evaluative technics. In view of the foregoing, a factor analysis of the data from an experimental design similar to that described in this paper, including psychologic, physiologic and biochemical evaluative technics is recommended.

RESUMEN

Los pacientes que han sido objeto de la terapia con electrochoque, presentan cambios definitivos en su integración, generalmente registrados por los clínicos en sus informes del progreso del enfermo. En este trabajo se propone que dicho registro no sólo sea de tipo descriptivo sino también conceptual. Vinson ha sugerido la posibilidad de evaluar la integración psicobiológica por los dibujos especulares usando esta técnica en la evaluación de cambios asociados con lobotomía, electrochoque y coma insulínico.

El diseño usado en las pruebas del dibujo especular, consta de ocho puntos que deben ser relacionados en serie, indirectamente visibles en el espejo. El primero y segundo puntos presentan la máxima dificultad; el tercero, cuarto y séptimo, la mínima, y el quinto y sexto la dificultad intermedia. Los puntos están dispuestos en tal forma, que existen tres juegos de ángulos de graduación similar y cada par de ángulos requiere estar orientado en dirección opuesta. Primero los pacientes practican sin espejo; después hacen las demostraciones sobre el espejo con un tiempo límite de dos minutos.

Después de haber realizado las pruebas con los dibujos especulares, se llegó a las conclusiones siguientes: es posible determinar la orientación en cuanto al tiempo y lugar por las pruebas del dibujo especular, evaluar la respuesta al tratamiento por la prueba del dibujo especular, predecir el pronóstico clínico por la evaluación de la respuesta al tratamiento, hasta donde el pronóstico clínico a corto plazo y el pronóstico clínico a largo plazo están asociados y predecir el pronóstico clínico a largo plazo por la prueba del dibujo especular.

RESUME

On observe des changements nets dans l'intégration des sujets qui ont été traités par la thérapeutique à base d'électro-chocs. Ces changements sont generalement consignés sous forme de rapport par les cliniciens dans leur mémorandum de progrès, et la suggestion proposée ici est d'utiliser ces dèclarations non seulement au point de vue descriptif, mais encore au point de vue conceptuel. Vinson a suggéré la possibilité d'évaluer l'intégration psycho-biologique par la méthode du dessin en miroir ou dessin spéculaire, et indique que cette technique se prêterait à l'évaluation des changements associés aux thérapeutiques de lobotomie, d'électro-chocs et de coma par l'insuline.

Le tracé adopté dans les essais de Dessin en Miroir consiste en huit points à relier en série, indirectement visibles dans un miroir. Le premier et le deuxième points présentent un maximum de difficulté; les troisième, quatrième et septième points offrent un minimum de difficulté; et les cinquième et sixième points comportent une difficulté moyenne. Les points sont disposés de telle manière qu'ils donnent trois séries d'angles d'un même nombre de degrés, et que chaque paire d'angles exige l'orientation en sens opposés. Le sujet commence par s'exercer sans le miroir; ensuite, il fait la démonstration sur le miroir, en un temps limite de deux minutes.

Après l'exécution d'essais décisifs par dessin en miroir, on est arrivé aux conclusions

suivantes: il est possible d'évaluer l'orientation en temps et en lieu par les essais de Dessin au Miroir; il est possible d'estimer la réaction au traitement par la méthode du Dessin au Miroir; il est possible de prédire le pronostic clinique par l'évaluation de la réaction au traitement; pour autant que le pronostic clinique à court terme s'associe au pronostic clinique à long terme, il est possible de prédire également le pronostic clinique à long terme au moyen des essais de Dessin au Miroir.

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CORRECTION

In the July-September, 1951, issue of the *Journal of Clinical and Experimental Psychopathology* in the article "The Schizophrenias of Childhood," the sentence beginning in the last line on page 226 which read: "This dosage was increased with each succeeding day of treatment by 0.5 mg. of histamine . . ." should be corrected to read: "This dosage was increased with each succeeding day of treatment by .05 mg. of histamine . . . ."